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- Representative: Ayers, Martyn Lewis Stanley et al J.A. KEMP'&'CO. 5 por ascent anti-no state of numerical action 14 South Square to held and the great meditionals of the bed. Gray's inno base-cos at refront of ogne, consubations London WC1R SEX (GB) 2 YS SITE 201 HD WAS ORDER INDINE อีกเมื่อที่ภูลิเลยีเชื้อว่า ที่สีรีพ อูกอออกระเวลียวอุทธาชุวตระ คล ลี

#### (54)INFORMATION PROCESSING METHOD, INFORMATION PROCESSING DEVICE AND MEDIA and the state of the stat ed numer ve manatorin accused cixcling (ATP 1.0) sysa can'i bolohab eta a sago o'laba yat galfas edega nijir a, a

(57)The recording area of a recording medium is separated into a first region and a second region. The basic information among plural channels is recorded in the first region and the remaining subsidiary information is recorded in the second region. As the basic information is tion, digital audio signals of at least the left, center, right, surround left, surround right and sub-woofer channels are recorded." As the subsidiary information, idigital audio signals of at least the left center channel; right center channel, delayed center channel, mixed left ... channel and mixed right channel are recorded. If the information recorded in one of the regions is lost, it is reproduced using the information of the other region during subsequent reproduction. In addition, the digital audio signals of six channels (L; LC; C; SW, RC and R) among the digital audio signals of the eight channels (L. LC, C, SW, RC, R, LB and RB), which digital audio signals of the six channels are psychoacoustically more crucial than those of the remaining two channels, are compression encoded with a higher audibility conforming to the human acoustic sense, while the digital audio signals of the two channels (LB, RB) are encoded with a higher compression ratio. In this manner, compression encoding with higher sound quality may be achieved for the crucial sound, while avoiding the wasteful bit allocation (wasteful byte allocation quantity).

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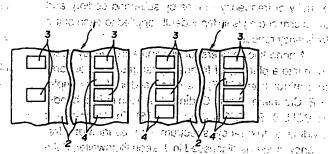
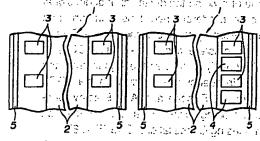


FIG.1b and



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### Description

# TECHNICAL FIELD

This invention relates to an information processing 5 method for encoding multi-channel digital audio signals employed in, for example, a stereo sound system for a motion picture film projection system, video tape recorder or a video disc player, or a so-called multi-surround acoustic system, and decoding the encoded data: 10 The invention also relates to an apparatus for carrying out the information processing apparatus and a medium having the encoded data arrayed thereon.

### BACKGROUND ART

There are a variety of techniques for high-efficiency encoding of audio data or speech signals, such as blocking frequency spectrum dividing system, known as transform coding, or a non-blocking frequency spectrum dividing system, known as sub-band coding. In the transform coding, digital audio data on the time domain is divided into time blocks, each of which is transformed into data on the frequency axis by orthogonal transform, and the resulting data on the frequency axis is further divided into plural frequency ranges for encoding from one frequency range to another. In sub-band coding, we digital audio data on the time axis is divided into plural frequency ranges for encoding without dividing the timedomain digital audio data into time blocks. In a combina-30 tion of sub-band; coding and transform; coding adigital; 1748 signals representing the audio signals are divided into a plurality of frequency ranges by sub-band coding, and transform coding is independently applied to each of the frequency ranges.

Among known filters for dividing a frequency spectrum into a plurality of frequency ranges is the quadrature mirror filter (QMF), as discussed in, for example, R.E. Crochiere, Digital Coding of Speech in Sub-bands, 55 BELL SYST. TECH. J. No.8 (1976). The technique of dividing a frequency spectrum into equal-width frequency ranges is discussed in Joseph Rothweiler, Polyphase Quadrature Filters: A New Sub-band Coding Technique, ICASSP 83 BOSTON.

Among known techniques for orthogonal transform is the technique of dividing the digital input audio signal into frames of a predetermined time duration, and processing the resulting frames using a Fast Fourier Transform (FFT), discrete cosine transform (DCT) or modified DCT (MDCT) to convert the signals from the time axis into the frequency axis. Discussion of a MDCT may be found in J.P. Princen and A.B. Bradley, Subband/Transform Coding Using Filter Bank Based on Time Domain Aliasing Cancellation, ICASSP 1987.

In a technique of quantizing the spectral coefficients resulting from an orthogonal transform, it is known to use sub bands that take advantage of the psychoacoustic characteristics of the human auditory system. In this, spectral coefficients representing an audio

signal on the frequency axis may be divided into a plurality of critical frequency bands. The widths of the critical bands increase with increasing frequency. Normally, about 25 critical bands are used to cover the audio frequency spectrum of 0 Hz to 20 kHz. In such a quantizing system, bits are adaptively allocated among the various critical bands. For example, when applying adaptive bit allocation to the spectral coefficient data resulting from MDCT, the spectral coefficient data generated by the MDCT within each of the critical bands is quantized using an adaptively allocated number of bits.

Among known adaptive bit allocation techniques is that described in IEEE TRANSON ACOUSTICS, SPEECH AND SIGNAL PROCESSING, VOL. ASSP-25, No.4 (1977 august) in which bit allocation is carried out on the basis of the amplitude of the signal in each critical band. In the bit allocation technique described in M.A. Krassner, The Critical Band Encoder-Digital Encoding of the Perpetual Requirements of the Auditory System, ICASSP 1980, the psychoacoustic masking mechanism is used to determine a fixed bit allocation that produces the necessary signal-to-noise ratio for each critical band.

In high efficiency compression encoding system for audio signals, employing the above-mentioned subband coding, a system has already been put to practical use which compresses the digital audio signals (audio data) to about one-fifth by taking advantage of psychoacoustic characteristics of the human auditory system. As the high efficiency encoding system of compressing the audio data to about one-fifth, there is known a so-called adaptive transform acoustic coding (ATRAC) system.

In a stereo or multi-surround acoustic system, such as a motion picturer film projection system, a high definition television, video tape recorder or a video disciplayer system, as in the usual audio equipment, the tendency is towards handling audio or speech signals over plural channels, such as four to eight channels. In these cases, it has ben desired to perform high efficiency coding for reducing the bit rate.

In professional application, above all, it is preferred to handle multi-channel digital audio signals, such that an equipment handling 8-channel digital audio signals is becoming popular. An example of such equipment handling the 8-channel digital audio signals is a motion picture film projection system. On the other hand, with the stereo or multi-surround acoustic system, such as a high-definition television, video tape recorder or a video disc player, the tendency is similarly to handle multi-channel, such as 4 to 8 channel, audio or speech signals.

With the motion picture film projection system, handling the 8-channel digital audio signals, it is currently practiced to record digital audio signals on the motion picture film over 8 channels, that is a left-, left center-, center-, right center-, right, surround left-, surround right- and sub-woofer channels. These eight channels, recorded on the motion picture film, are respectively

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associated with a left speaker, a left center speaker, a DISCLOSURE OF THE INVENTION center speaker, a right center speaker, a right speaker, and tensor a sub-woofer speaker, arranged towards a screen on which the picture reproduced from the picture recording tor, and a surround left speaker and a surround right war speaker, arranged on the left and right sides of the spectators' seats. A Marriagle of each to be an increasing

For recording the 8-channel digital audio signals on the motion picture film, it is difficult to acquire a region on the motion picture film for recording as many as eight channels of compressed digital audio signals (audio data) linearly quantized with 16 bits with the sampling frequency of 44.1 kHz, such as those for a compact disc - จุลเปรากับ เกาะเกาะ และ เกาะเกาะ เกาะเกาะ เกาะเกาะเกาะ (CD).

On the other hand, a motion picture film as a recording medium is susceptible to surface scratches, so that it cannot be practically employed if the digital data as such is directly recorded thereon because of severe data dropout. Thus the role of the error correction code becomes crucial, such that it becomes necessary to effect data compression so that not only the digital data but the correction code can be recorded in the recording region on the film. However, since the mation, while the second information also includes the mation, while the second information also includes the coding for compression results in the human speech or 25% sound information assets the instance as an appropriate the sound from a musical instrument being transmuted. The basic information is the information of the free constant from the original sound; it necessary to take some the quency range lower than that of the subsidiary informations of the subsidiary informations of the subsidiary information and the subsidiary information of the su measures for improving the sound quality for crucial in the subsidiary information is: a grequentized guiltic. sound, such as human speech, if the coding for com- sample of the quantization error of the basic informapression is exploited in a recording format for a record- is a stion. If it is brodge that new weed there exists a still protect them. ing medium which is in need of faithful regeneration of which is the pre-set medium includes a motion picture film and the the original sound, such as the above-mentioned in the disc-shaped recording medium or a communication of motion picture film. The ease generation in the estimacing of

recording medium, such as the above-mentioned those between the perforations and the edge of the above-mentioned motion picture film, but also for recording speech data, and motion picture frame, and those between the perforage and encoded for data compression, on other recording tions of the motion picture film and the edge of the media, such as a magnetic disc, magneto-optical disc, 40 emotion picture film and between the perforations. The an optical disc, a phase-transition optical disc or a magnetic tape. This applies to the case of recording picture are arrayed separately between one and the other rows data, encoded for compression, for the above-men- appropriations, to pay men and conscituding arrise and in tioned recording media. S. passessery no more selection

picture is also desirable when recording digital signals with is arrayed as the first digital information. Brill projections of the speech or picture on the above-mentioned various recording media without encoding for data compression. 1974 Of the other table is with the contract of the

In view of the foregoing, it is an object of the present invention to provide a method and apparatus for processing the information capable of encoding and decoding with high sound or picture quality even if the speech or picture is not encoded for compression, and a recording medium having the encoded information recorded thereon.

Barton Colored

The present invention is proposed for achieving the above object, and provides a method for processing the area of the motion picture film is projected by a project scinformation including encoding the first digital information to be arrayed in plural regions proximate to information regions on a pre-set medium in which the second information is arrayed, and/or decoding the encoded of the first digital information arrayed in plural regions proximate to regions on the pre-set medium in which the second information is arrayed. The first digital information has the pre-set basic information and the subsidiary information for completing the basic informations a season to the completing the basic informations a season to the completing the basic information as the completing the completing the basic information as the completing the compl

> The present invention also provides a method form 15 improcessing the information for recording the information of plural channels on a recording medium, in which pluand recording regions of the recording medium are individed into a first region and a second region, the basic information among plural channels is recorded in the 20 first region as the first digital information and the subsidiary information is recorded in the second region as the second region.3746.bit is to more formed a causal are to push a give

The first digital information includes the sound information in the sound in t

network. Hotal out to little them admoduse and leanagh analy-

Of course, the sound regeneration more faithful to the sound regions for the first digital information are the original sound, such as is described above, is 35 those between perforations of the motion picture film, or 1950 required not only for recording speech data on the second perforations on the same side of the film,

With the information processing method of the same Such faithful regeneration of the original speech or 45 present information, the multi-channel audio information

> The basic information among the plural channels is  $g \in \mathbb{R}^n$ the audio information for the left, center and right channels, while the supplementary information is the audio information for the left center and right center channels. The supplementary information may include the information of the delayed center; channel, obtained on a second delaying the center channel audio information, the information of the delayed mixed left channel, obtained on 55 mixing the left channel audio information, left center channel audio information and the surround left channel audio information and delaying the mixed information. and the information of the delayed mixed right channel, and the obtained on mixing the right channel audio information,

right channel audio information and delaying the mixed

information, the basic information and the supplemen-no-serio quency analyses, the block size is adaptively changed tary information is the high-efficiency encoded information is the high-efficiency encoded information in the high-efficiency encoded information is the high-efficiency encoded information in the high-efficiency encoded in the hightion. In addition, in the information processing method of a 101 mals. Such change in block size is carried out independthe present information, the basic information and the metal ently for each of at least two output bands of the nonsupplementary information rarectime-domains or afrecing and blocking frequency analyses. quency-domain samples. Variable bit allocation is done in the information processing method of the present found from the scale factors and word lengths for the motive mean value of information signals of each channel cosed should sample data of the basic information. In the information of choice An apparatus information of the basic information of t processing method of the present invention; a bit allocation quantity to one of plural channels to which a bitime not information to be arrayed in plural regions proximate to quantity exceeding a pre-set constant reference quan- 1/25 in information regions on a pre-set medium in which the interest quantity exceeding a pre-set constant reference quantity is allocated is resolved into a bit quantity portion of deal second information is arrayed, and/or decoding means and a second information is arrayed, and/or decoding means the basic information which is the bit apportionment not as you for decoding the encoded first digital information and the the subsidiary information and bit apportionment not we supplementing the basic information.

invention, the same quantization is carried out of same plementing the basic information and become land ple data in a small-sized block divided along time and as all ing frequency analysis consisting in carrying out free: frequency analyses is carried out during decoding. For a relation. producing sample data in a mini-block divided along. The pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film, programme and the pre-set medium includes a motion picture film. time and frequency, a pre-set non-blocking frequency of a disc-shaped recording medium or a communication analysis consisting in carrying out frequency analyses - 55 % network. Indiameter betond a single of mules on transfer of without blocking is performed during encoding and pre-specific . The plural regions for the first digital information are partial. synthesis. The frequency bandwidth of the non-blocking those between the perforations and the edge of the

right center channel audio information and the surround is the frequency analyses, is selected to be the same in at least two lower most bands and to be broader with information. The recording medium employed in the increasing frequency in at least the highest frequency recording method of the present invention is a film, the band. For the non-blocking frequency analyses polyfirst region is a region between the film perforations and 5 m phase quadrature filters or quadrature mirror filters may the second region is a longitudinal film region, nebsyrous at the employed. The blocking frequency analyses include In the information processing method of the present modified discrete cosine transform in the blocking fre-

for time-domain or frequency-domain samples of plural invention, the sum of bit allocation portions for the basic channels among different channels and total quantity of 15% information and the bit allocation portions for the subsidbit allocation for the entire channels of the basic infor- and lary information for respective channels is changed mation and the supplementary information is rendered to a depending on the maximum sample value or the scale substantially constant. In addition, with the information to the factor of each channel, The channel bit processing method of the present invention the scale an apportionment is changed with time changes in amplifactors for sample data of the basic information are 20 tude information of an energy value, a peak value or a

including channel bit allocation and not exceeding the arrayed in plural regions proximate to information concerns reference quantity at most and a bit quantity portion to the regions on a pre-set medium in which the second inforcorresponding to the difference between bit apportion- 30 mation is arrayed. The first digital information has the ment including channel bit allocation as bit allocation of the pre-set basic information and the subsidiary information

including channel bit apportionment of the basic information, and variable bit apportionment is done to time of the includes encoding means for encoding the first digital domain or frequency-domain samples of plural channels from channel to channel. The sample data of bits appropriation regions on a pre-set medium in which the hearth allocation of the subsidiary information is given as a different sessecond information is arrayed, and/or decoding means problems ference between sample data obtained from bit apports a confor decoding the encoded first digital, information is more tionment including channel bit allocation and sample: 10 carrayed in plural regions divided by information regions hebotas data obtained from bit apportionment not including a 400 on a pre-set medium in which the second information is channel bit allocation. Visinemellique est bas notamons ocarraved. The first digital information has the pre-set surger of In the information processing method of the present sea a basic information and the subsidiary information sup-

In the information processing apparatus of the frequency. For producing sample data in small-sized a 45 present invention, the first digital information contains block divided along time and frequency, a pre-set-block-trees athe audio information, while the second information also at the second information also contains the audio information. The basic information is quency analyses for each of plural blocks consisting of the quantization samples or the information of lower freplural samples is carried out during encoding and pre- and equency bands than those of the supplementary information and preset frequency synthesis consisting in carrying out fre- 50 tion. The supplementary information is the re-quantized quency synthesis for data processed with the blocking and samples of the quantization error of the basic informasuccessful the informace capable of encoding and

set non-blocking frequency synthesis is performed on the entropy those between perforations of the motion picture film, data processed with pre-set non-blocking frequency between the perforations on the same side of the film, amotion picture frame and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for pre-set and those between the perfora-to-log non-blocking frequency synthesis means for the perfora-to-log non-blocking frequency synthesis means from the perfora tions of the motion picture film and the edge of the access non-blocking frequency analyzed data. The frequency motion picture film and between the perforations. The last transplant with for the non-blocking frequency analyses is basic information, and the supplementary information set so as to be equal in at least two lowermost bands. are arrayed separately between one and the other rows 0.5. Alternatively, the frequency width of the non-blocking

present invention; the multi-channel information its applia band. For the non-blocking frequency analyses, poly-

present invention, the basic information and the supple-size, modified discrete cosine transform. In the blocking frementary information are high-efficiency encoded infor- and place analyses, the block size is adaptively changed mation. The basic information and the subsidiary depending upon temporal characteristics of input siginformation are time-domain or frequency-domain same service in block size is carried out independples. Variable bit allocation is performed on the time- exis ently for each of at least two output bands of the nondomain and frequency-domain samples of plural channels. The apportionment of total bit allocation quantity of the state the bit allocation quantity for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention; the sum of bit allocation portions for the basic information and the present invention and the presen the bit allocation quantity of the subsidiary information, it was the basic information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation portions for the subsidiary information and the bit allocation information and the bit allocation and the subsidiary information and the subsidiary inform summed together, to the entire channels, is:set so as to 20, 4the subsidiary information for respective channels is, 4445 be substantially constant. Meanwhile the scale factors again changed depending on the maximum sample value or each for sample data of the subsidiary information are found restricted scale factor of each channel. The channel-to-chanfrom the scale factors and word lengths of sample data with new holds apportionment is changed with time changes in

present invention; a bit allocation; quantity to one of plural channels to which:a bit quantity exceeding a pre-set apparatus of the present invention includes memory of constant reference quantity is allocated is resolved into the horomeans for separating in each sync block, a bit allocated is resolved into the horomeans for separating in each sync block, a bit allocated is resolved. a bit quantity portion of the basic information which is a position sample group of the basic information allocating a group of the basic information allocating a group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position sample group of the basic information which is a position which it is a position of the basic information which is a position of the basic information which is a position of the basic information which it is a position of the basic information which is a position of the basi the bit apportionment not including channel bit alloca- 19-30 bit quantity larger than a pre-set reference quantity for tion and not exceeding the reference quantity at most, be an plural channels from the bit allocation sample group of and a bit quantity portion corresponding to the difference the remaining subsidiary information of the bit allocation ence between bit apportionment including channel bit the ample group of the basic information for plural channels and allocation:as bit allocation of the subsidiary information, and for recording on the pre-set medium, in the information of and bit apportionment not including channel bit apportion processing apparatus of the present invention the bit apportion. tionment of the basic information. Variable bit apportion to the basic information and the time of the basic information and the b ment is done to time-domain or frequency-domain. samples of plural channels from channel to channel and samples alternately recorded in each channel and samples are sent to a The sample data of bit allocation of the subsidiary infor-size 65.00 In the information sprocessing apparatus of the way. mation is given as a difference between sample data 40% present invention; the decoding means decode and obtained from bit apportionment including channel bit a reproduce the bit allocation sample group of the basic allocation and sample data obtained from bit apportion-securinformation; for plural channels, and the bit-allocation be a

present invention, the same quantization is carried out 45, recording medium in separation from each other in one of sample data in a small-sized block divided along time and sync block. The decoding means decode and reproand frequency. For producing sample data in the small- duce the bit allocation sample information of each chansized block divided along time and frequency, the sound alternately recorded in each channel in one sync encoding means is provided with pre-set blocking frequency analysis means for carrying out blocking fre- , 50 , jary information. The bit quantity larger than the pre-set quency analyses configured for performing frequency reference quantity is allocated depending on whether analyses for each block made up of plural samples, where the allocation bit quantity to the channel is larger than or while decoding means has pre-set blocking frequency equal to the reference quantity of the subsidiary inforsynthesis means for pre-set blocking frequency analyzed data. For producing sample data in the small-, 55 7 9 With a medium of the present invention, the first sized block divided along time and frequency, the size digital information having the basic information and the encoding means is provided with pre-set non-blocking frequency analysis means for carrying out non-blocking frequency analyses while decoding means has pre-set

of perforations; and perform and presentation includes the interpretation of perforations; and perforations and presentation of perforations; and perforations and presentation of perforations; and perforations are presentations and perforations and perforations are presentations. In the information processing apparatus of the top increase in frequency in at least the highest frequency arrayed as the first digital information with tot not such as phase quadrature filters or quadrature mirror filters may In the information processing apparatus of the 210 abe employed. The blocking frequency analyses include

of the basic information is low postson of a viscostate viscostate and amplitude information of an energy value, a peak value, and In the vinformation processing apparatus to further 25 the amount of information signals of each channel.

ment not including channel bit allocation and a your season sample group of the subsidiary information for plural In the information processing apparatus of the components taken out after recording on the pre-set

> subsidiary information completing the basic information is arrayed in plural regions excluding those for arraying the second information. The basic information and the

the above-described method for processing the infor-again regeneration revenificone of the regions becomes to the mation. St specifies governed preferred and red individual entered of the recorded information and one mild sectors are a

With the information processing method and appation has not only the pre-set basic information but also the supplementary information of the basic information, the basic information can be encoded and decoded with high quality using the supplementary information.

Also, according to the present invention, the first digital information contains the audio information, while

error of the basic information, so that the signal-to-noise

work. If the pre-set medium is a motion picture film, the cases basic information, and erost stylinoitem of more and entitle to a continuous statement of the pre-set medium is a motion picture film, the cases basic information, and erost stylinoitem of more and erost stylinoitem of the pre-set medium is a motion picture film, the cases basic information, and erost stylinoitem of more and erost stylinoitem of the pre-set medium is a motion picture film, the cases basic information, and erost stylinoitem of the pre-set medium is a motion picture film, the cases basic information and erost stylinoitem of the pre-set medium is a motion picture film, the cases basic information and erost stylinoitem of the pre-set medium is a motion picture film, the cases basic information and erost stylinoitem of the pre-set medium is a motion picture film, the case of the pre-set medium is a motion picture film, and the pre-set medium is a motion picture film, and the pre-set medium is a motion picture film, and the pre-set medium is a motion picture film, and the pre-set medium is a motion picture film, and the pre-set medium is a motion picture film. plural regions for the first digital information may be some in addition, according to the present invention, the those between perforations of the motion picture film, were same quantization is effected of the respective sample a second between the perforations on the same side of the film, those between the perforations and the edge of the 40% quency. The sample data in the small-sized block may: motion picture frame and those between the perforations of the motion picture film and the edge of the transfanalyses during decoding and by performing pre-set wish a motion picture film and between the perforations, in some blocking frequency synthesis during decoding, while the order to make effective utilization of the film regions sample data may also be obtained by performing preother than the picture regions: In addition, by separately 45% set non-blocking frequency analyses during encoding arraying the basic information and the supplementary and on and by performing pre-set non-blocking frequency syn-access. information between perforations of one of the rows of the thesis during decoding. According to the present inventhe perforations and between perforations of the other size intion, the frequency bandwidth of the non-blocking is the size in the perforations and between perforations of the other size into the size in the si row of perforations, the region for the basic information as the frequency analyses may be equated in at least two in a and the supplementary information may be secured; 50 clower most frequency bands or may be set to be year

regions of the recording medium are divided into a first of equency analyses, polyphase quadrature filters or quadregion and a second region, the basic information and arrature mirror filters may be employed. The blocking asset among the plural channels are recorded in the first 55 region and the remaining supplementary information is the stransform. In the blocking frequency analyses, the block of the recorded in the second regions. Thus, by employing the size is adaptively changed depending upon temporal regions between film perforations as the first region and the characteristics of input signals. Such change in block the first region and the characteristics of input signals. Such change in block the first region and the characteristics of input signals. by employing the longitudinal region as the second size is carried out independently for each of at least two

subsidiary information are the information encoded by the region, the opposite side information may be used for a region, the opposite side information may be used for

Further, according to the present invention, by ratus of the present invention, the digital information is a sample and information as the first are a sample and information as the sample and information are a sample and information as the sample and information are a sample and a sample are a sample and a sample are a sa encoded, and the first digital information thus encoded digital information, compressing the information with the is arranged in plural proximate regions and in plural sales basic information and the supplementary information as regions divided by information regions in which the second information is arranged, so that the second information is allocation for time-domain or frequency-domain to second information is arranged, so that the second information is allocation for time-domain to second information in the second information is allocation for time-domain to second information in the second information is allocation in the second information in the second in the second information in the second in the second information in the second in the s tion is related in its position with the first information on samples of the basic information and the supplementhe medium. In addition, since the first digital informating the total bit allocation quantity for the total channels of the sum of the bit allocation quantity to the respective information data socasato be substantially constant; effective bit utilization may be achieved. This may be 37 3 realized by resolving the bit allocation quantity to the channels to which the bit quantity larger than a pre-set the second digital information also contains the audio these reference quantity is allocated into a bit quantity portion and the information, eso that the present invention may be see not the basic information which is the bit allocation not in 10 . applied to a variety of applications handling the audio 20 a containing the channel bit allocation not exceeding a 3-3-3 information. Such a signise mumixism and no principal begins constant reference quantity at/most/and-abit quantity. With the information processing method and appa-9333 apportion which is a difference between the bit allocation grant ratus according to the present invention, the basic infor- containing the bit quantity portion as the bit allocation are a mation is quantized samples, while the supplementary and one supplementary information and the bit allocation so an analysis of the supplementary information and the bit allocation so a supplementary information and the bit allocation and the bit alloca information is re-quantized samples of the quantization 25% not containing channel bit allocation of the basic information, and by performing variable bit allocation of toward ratio in the encoding and decoding of the basic informations are respective samples of respective channels among differences to tion may be improved. In addition, if the basic informations ferent channels. Meanwhile, the sample datasconcerns the sample of the basic information of the channels. tion is the information of the frequency band lower than the fling bit allocation to the supplementary information may be the that of the supplementary information, and if the basic solution be given as a difference between sample data resulting solutions. information is eig. the audio information; the low free to issufrom bit allocation containing channel bit allocation and beautions. quency band which is crucial acoustically may be sample data resulting from bit allocation not containing improved in quality should not smooth observed in our second channel bit allocation. The scale factor for sample data to the control of the scale factor for sample data to the control of the scale factor for sample data. The pre-set medium may be a motion picture film, and the supplementary information is found from the word was a second from the w disc-shaped recording medium or a communication net is 35% length and the scale factor for the sample data of the seasons.

data in a small-sized block divided as to time and frewhile the number of usable bits may be increased. The broader in at least the highest frequency range for According to the present invention, plural recording and anothing to the hearing sense. For the non-blocking frefrequency analyses include modified discrete cosine as a second second analyses include modified discrete cosine as a second sec output bands of the non-blocking frequency analyses for the second enabling frequency analyses matched to input signal as characteristics. The engine to the now place

In addition, bit allocation matched to input signal characteristics may be achieved by changing the sum of 5 the bit allocation portion for the basic information for the respective channels and that for the supplementary information depending upon the scale factor or the maximum sample values of the respective channels, by changing the channel-to-channel bit allocation by time 10 changes in the amplitude information of the energy values of the information signal of respective channels or page, for a compression encoding circuit; to the problems of the information signal of respective channels or page, for a compression encoding circuit; the peak or mean values thereof, or by changing the bit allocation for respective channels depending on time was tive construction of an adaptive bit allocation circuit for

Further, with the information processing apparatus of the present invention, each sync block is divided into access a a group of bit allocation samples of the basic information plural channels in a compression encoding circuit. tion allocating the bit quantity larger than a pre-set referremaining bit allocation samples of the supplementary as a sinformation signals among plural channels. The supplementary as a sinformation signals among plural channels. information of the bit allocation sample groups of the angles recorded by recording means on a pre-set recording thou tionment (1) and tonality: The state states of the state of the st medium. Recording of the bit allocation sample group of a 25 and group of the supplementary information is effected alter-states tionment (1) and time rate of change. 1980 1980 1990 1990 nately for respective channels, all the information as all processing apparatus of the present invention; decode as accuniform apportionment, as details. In processing apparatus of the present invention; decode as accuniform apportionment, as details. ing means effect decoding and reproduction from the bit 30 % of one sync block of a pre-set medium.: If the respective bit o and, effects, the conductive of a great base of how light as the last allocation sample groups are alternately recorded from High Fig. 1 channel to channel, the decoding and reproduction are 35% struction of an adaptive bit allocation circuit for realizing effected lineal similar emanner. The decoding means and a bit allocation scheme employing both the magnitude employers detects a channel for which a bit quantity is larger than series of information signals and the acoustically allowable the a reference quantity based on whether the bit allocation on somnoise spectrum, general professional consequences quantity to the channels is larger than or equal to a reference of erence quantity of the supplementary information which ... 40 ... a circuit for finding the allowable noise level ... ... is smaller than a constant reference quantity. 36.1 (\$12.06.7 p. 16)

With the medium of the present invention, the infor- enter threshold by the signal levels of the respective bands: mation encoded in accordance with the information goes or tion is arrayed for effective utilization of the arrayable 20.45 - limit. region for improving the quality of the arrayed informa-

านอาเทศ ครั้งการ (100) อริกาศุรภิษาแดง ซูก เช่า

# BRIEF DESCRIPTION OF THE DRAWINGS:

tabone of yourself lead of strange. Fig.1 shows a motion picture film as an example of the medium of the present invention and the manner in war which the first digital information and the second information are arrayed on the motion picture films, to proceed

Fig.2 shows a speaker arrangement in an 8-chan- 55 level for low-tonality information signals. nel digital surround system. Proprosession of the control of

Fig.3 is a block circuit diagram showing a construction of an illustrative example of a compression encoding circuit of an information processing apparatus for

carrying out the information processing method of the present invention, with the example being that in which bit apportionment among the channels is not carried From Mission Company and Ages

Fig.4 is a block circuit diagram showing a construction of an illustrative example of a compression encoding circuit of an information processing apparatus for carrying out the information processing method of the present invention, with the example being that in which bit apportionment among the channels is carried out."

Fig.5 shows frequency and time division of a signal

Fig.6 is a block circuit diagram showing an illustrachanges of the scale factors of the respective channels. 15 finding bit apportioning parameters for multiple channels in a compression encoding circuit. A matter of the

Fig.7 is a graph showing bit apportionment among

Fig.8 shows how to find parameters for bit apporence quantity://fore-plural-channels/and-sa-\*group--of---2000 tionment-in-consideration of time-characteristics of the

Fig.9 is a graph showing the relation between the basic information, hand these sample groups have the amount of bit apportioned in accordance with bit apport-

Fig.10 is a graph showing the relation between the 195 3 the basic\_information\_and; the: bit\_allocationdsample: FB... amount of bit apportioned in accordance with bit appor-

Fig.11 is a graph showing the noise spectrum for

Fig.12 is a graph showing a frequency spectrum of allocation samples of the basic information and the supplementary information recorded in separated state in the apportionment for producing level-dependent acoustic

Fig.13 is a block circuit diagram showing a con-

Fig.14 is a circuit diagram showing a construction of

Fig.15 is a graph showing an example of a masking

Fig.16 is a graph showing the information specprocessing method and apparatus of the present inven-TWO WELLS IN THE WORLD BUT TO RESERVE THE TAIL OF THE PARTY OF THE PAR

Fig.17 is a graph showing bit allocation dependent escribed NOV medical set is an protection of a control of the signal level for low-tonality information signals and it  $\omega$  and bit allocation dependent on the acoustically allowa-  $\psi$  if esticate or ble noise level. The last of the status of the

> Fig.18 is a graph showing bit allocation dependent on the signal level for high-tonality information signals and bit allocation dependent on the acoustically allowa-... ble noise level. The August All Contraction

Fig.19 is a graph showing the quantization noise

Fig.20 is a graph showing the quantization noise level for high-tonality information signals.

Fig.21 is a graph showing bit apportionment for eight channels.

tive construction of a circuit for dividing the bit allocation to the signature set proces memorately s

Fig.23 is a block circuit diagram showing an illustrative construction of an expansion decoding circuit for 5 expansion decoding compression encoded digital audio 100000 signals of the respective channels activated in the durable of

Fig.24 is a graph showing bit apportionment for five and a channels, who rit sample baing that in cable to channels with the sample bains and the channels with the sample bains and the channels with the channels with the channels with the channels will be compared to the channels with the channels will be channels with

Fig.25 is a block circuit diagram showing an illustra-0.310 000 tive construction of a compression encoding circuit for compression encoding digital audio signals of respective as speaker of 04; accenter espeaker of 02; as right-center of accenter of accente tive channels of an alternative embodiment. Rould in at P. S.

Fig.26 is a block circuit diagram showing an illustrative construction for determining bit apportionment for 15 respective channels in the alternative embodiment of the compression encoding circuit, provided tigme is to 3

Fig.27 is a block circuit diagram showing an illustra-to-en tive construction of an expansion decoding circuit for expansion decoding the compression encoded digital : 9200 audio signals of the respective channels of the alternation and tive embodiment. So nobsest calt province registy & at 9 s

Fig.28 shows a disc-shaped recording medium as much an alternative example of a medium according to the propresent invention, ad lead of ear spewded again as the 25 ide as he driving in reported in the modificing his to the ar

# BEST MODE FOR CARRYING OUT, THE INVENTION OF THE

Fig.11 is a reaph showing me noice spectrum for

of the present invention will be explained in details at 15 1, 30

Fig. 1 shows how the first digital information and the according second information are recorded once motion picture and other audio data of the left channel and the playback of film 1 as an example of a recording medium according sound by the audio data by the right channel for displayto a first embodiment of the present invention of a large state of

explained include recording regions, 4 defined between the hid center speaker 102 on one hand and the left and right are perforations:3 of:a motion picture film:1, as shown in the Fig.1a, transversely aligned recording regions 401 000 between the perforations 3 on both edges of the motion ( picture film 1 as shown in Fig.1b, longitudinal recording 2940:0 regions 5 between the edges and the perforations of the motion picture film thas shown in Fig.1c and recording to an regions 5 between the edges and the perforations of the motion picture film 1 and recording regions 4 between \*\* the perforations 3 of the motion picture film 1 as shown in Fig.1d. It is noted that the digital audio signals (audio data) as the basic information of the first digital information and the quantization error information or subsidiary information as the supplementary information are arrayed separately, for example, between the perforations 3 on one lateral side, e.g., on the right side, and between the perforations 3 on the opposite lateral side, % e.g., on the left side, of the motion picture film 1. In the picture recording regions 2; are recorded pictures, that is picture frames, as the second information. The VPIDCORVIN

In the present embodiment, the above-mentioned motion picture film 1, for example, is employed as the recording medium. The first digital information recorded on the motion picture film 1 is the multi-channel sound:

ु Fig.22 is a block circuit diagram showing an illustra का का sinformation; as an example. The channels in this case क are associated with respective speakers of the digital surround system, as shown for example in Fig.2. That:::is, associated with the respective speakers are eight channels, namely, a center (C), channel, a sub-woofer is a (SW) channel, a left (L) channel, a left center (LC) channel, a right (R) channel, a right center (RC) channel, a left surround (LB) channel and a right surround (RB) channel, di jarendado evribegado ado to aprelav electrico m

That is, referring to Fig.2, the respective channels and are associated with a left speaker 106, a left-center 200speaker#105; galigright: speaker = 107, #a #surround-left ##### speaker:108, a surround-right:speaker 109 and a subwoofer speaker 103, arranged towards a screen 101, on -which a picture reproduced from the picture recording regions 2 of the motion picture film is projected by a projector 100 model, přesel son rol aarorezo horhouliz su rolimu at l

The center speaker 102, arranged at a center position on the side of the screen 101, outputs the playback sound of the audio data of the center channel. Thus it was outputs the crucial playback sound, such as actors' or actresses'adialogue. The sub-woofer speaker 103 for outputting the playback sound by the audio data of the sub-woofer channel outputs the sound which is perceived as vibrations, such as the sound of explosion, rather than⊪as∋the⊞ow-range sound⊛∓hus;∈in- many ⊃ quo cases, the speaker 103 is effectively employed for Referring to the drawings, preferred embodiments of a scenes of explosions. The left speaker 106 and the right speaker 107, arranged on the left and right sides of the screen 101 respectively, output the playback sound by ing stereophonic effects. The left center speaker 104 The regions for the digital information as later 335 and the right center speaker 105 arranged between the 350 speakers 106, 107 on the other hand, output the playback sound by the audio data of the left center channel and the playback sound by the audio data of the right center channel and assist in the operation of the left and right speakers 106, 107, respectively. In a motion picture theater having a large-sized screen and capable of holding a large number of guests, localization of the sound image tends to be unstable depending on the seat positions. Thus a more realistic sound image localization may be achieved by annexing the left center speaker 104 and the right center speaker 107. In addition, the surround left speaker 108 and the surround right speaker 109, arranged for surrounding the spectators' seats, output the playback sound by the audio data of the surround left channel and the audio data of the surround right channel thus giving the spectators the impression of being wrapped in a reverberating sound, hand clapping or shout of joy. The above contributes to 55 increation of a more stereophonic sound image. A AMILIA S

The information processing method of the embodiment illustrated herein is used for encoding/decoding the first digital information to be recorded on the recording regions 4 or the longitudinal recording regions 5 of the motion picture film 1, employed as a recording and another band-dividing filter 12, such as QMF, into a sigmedium. The information processing apparatus of the nal in a range of 0 Hz to 5.5 kHz and a signal in a range present embodiment is employed for carrying out the of 5.5 kHz to 11 kHz. The signal in the range of 1.1 kHz

ing method of the present invention is explained in signal in the range of 5.5 kHz to 11 kHz from the banddetail.

out the information processing method of the present 10 MDCT circuits 14 and 15, respectively. recording regions 4 or the longitudinal recording regions . 5 of Fig.1, arrayed in proximity to or on both sides of the picture recording region 2 comprised of picture frames domain or MDCT coefficient data. expansion decoding circuit is a decoding means for 20 block determining circuits 19, 20 and 21 is supplied to decoding the encoded first digital information from the motion picture film 1 in which there is pre-recorded the first digital, information encoded by the compression encoding circuit. e to imescifio iki tri priorije ime

now explained.

In the compression encoding circuit, shown in Fig.3, an input digital signal is split by a filter bank into plural frequency bands and orthogonal-transformed from band to band to produce spectral data on the frequency axis. The resulting spectral data on the frequency axis are encoded using adaptively allocated bits for each critical band which takes into account the psychoacoustic characteristics of the human auditory system as later explained. For higher frequencies, the critical bands are further divided into sub-bands. The widths of frequency division for the non-blocking method may naturally be of equal widths. In addition, with the present embodiment, the block sizes (block lengths) are adaptively changed prior to orthogonal transform responsive to input signals, and block floating is performed for each critical band or each sub-band divided from the critical band for higher frequencies. The critical band is a frequency band that takes advantage of the psychoacoustic characteristics of the human auditory mechanism. A critical band is the band of noise that can be masked by a pure sound that can be masked by a pure sound that has the same intensity as the noise and has a frequency in the vicinity of the frequency of the noise. The width of the critical band increases with increasing frequency of the noise. The entire audio frequency range of 0 Hz to 22 kHz can be divided into, for example, 25 critical bands.

Referring to Fig.3, a PCM audio signal in the frequency range of 0 Hz to 22 kHz, for example, is supplied to an input terminal 10. The spectrum of the input signal is divided into frequency ranges of 0 to 11 kHz and 11 to 22 kHz by a band-dividing filter 11, such as QMF. The signal in the range of 0 to 11 kHz is further divided by

information processing method of the present invention. to 22 kHz from the band-dividing filter 11 is supplied to Referring to the drawings, the information process- 35 %, a modified discrete cosine transform (MDCT) circuit 13. ing apparatus for carrying out the information process- as an example of an orthogonal transform circuit. The SS stanting of Judico and always on resist or a resource, dividing filter 12 and the signal in the range of 0 Hz to The information processing apparatus for carrying 5.5 kHz from the band-dividing filter 12 are supplied to

Figs.3, 4 and 25, and an expansion decoding circuit; nals of the respective bands from the band-dividing filshown in Figs.23 and 27 The compression encoding the ters 11, 12 with MDCT based upon the block sizes circuit is an encoding means for encoding the first digital determined as described below by the block size deterinformation recorded in plural regions, such as the 15 mining circuits 19, 20 and 21 associated with the respective bands. In this manner, the respective band signals are converted to spectral data in the frequency

> adaptive bit allocation and encoding circuits 16, 17 and 18, respectively, while being outputted at output terminals 23, 25, 27, respectively, 100 5, 24 Stora incommentation 100 c.

On the other hand, outputs of the MDCT circuits 13, 100 and 15 The compression encoding circuit shown in Fig.3 is 25 14 and 15 are supplied to adaptive bit allocation encoding circuits 16, 17 and 18, respectively, where the energy for the critical bands or sub-bands further divided from the critical bands for the higher frequencies are found by calculating root mean squares of respective sections 30, tive amplitude values in the respective bands. Of course, the scale factors as later explained may be employed for the subsequent bit allocation, in which to be a case new arithmetic-logical operations for finding the energy may be dispensed with thus resulting in saving of the hardware scale. The peak or mean values of the amplitude values may also be employed in place of the band-based energy. The spectral data in the frequency domain or MDCT coefficient data, obtained by MDCT operations by the MDCT circuits 13 to 15, are grouped for the critical bands or sub-bands divided further from the critical bands for higher frequencies, so as to be a many transmitted to the adaptive bit allocation encoding circuits 16, 17 and 18, respectively.

The spectral data or MDCT coefficient data are requantized, that is normalized and quantized, by the adaptive bit allocation encoding circuits 16, 17 and 18, depending on the above-mentioned block size information and the number of bits allocated for the critical bands or the sub-bands divided further from the critical bands for the higher frequencies. Data encoded by the adaptive bit allocation encoding circuits 16, 17 and 18 are outputted at output terminals 22, 24 and 26, respectively. The adaptive bit allocation encoding circuits 16, 17 and 18 also find the scale factor, that is a factor indicating which signal magnitude has been used as the basis for normalization, and the bit length information, that is an information indicating which bit length has been used for quantization. These two information data are also outputted at the output terminals 22, 24, 26.

r. The outputs of the output terminals 22 to 27 are combined together so as to be outputs of the respective compression encoding circuits.

In the example of Fig.3, there is shown a construction of a compression encoding circuit for encoding a digital audio signal of an optional channel among plural channels in case bit allocation is done independently for the respective channels. It is also possible to effect bit apportionment for the respective channels.

The construction of a compression encoding circuit for encoding the digital audio signal of the optional channel in case bit apportionment is done among the plural channels for compression encoding is shown in Fig.4, in which the components other than the adaptive bit allocation encoding circuits 16, 17 and 18 are basically the same as the corresponding components shown in Fig.3.

In the compression encoding circuit shown in Fig.4, an illustrative example of the block sizes determined by the MDCT circuits 19 to 21 similar to those shown in Fig.3 is shown in Fig.5a and 5b. Figs.5a and 5b show the long orthogonal transform block size, that is the orthogonal transform block size for the long mode, and the short orthogonal transform block size, that is the orthogonal transform block size for the short mode, respectively. In the illustrative example of Fig.5, each of the three filter outputs has two orthogonal transform block sizes. That is, for the signal in the low frequency range of 0 Hz to 5.5 kHz and for the signal in the mid frequency range of 5.5 kHz to 11 kHz, the number of samples in each block is equal to 128 as shown in Fig.5a of equal to 32 as shown in Fig.5b, when a long block size or a short block size is selected, respectively. On the other hand, for the signal in the high frequency range of 11 to 22 kHz, the number of samples in each orthogonal transform block is set to 256 if the long block length as shown in Fig.5a is selected, whereas, if the short block length is selected, as shown in Fig.5b, the number of samples in each block is set to 32. In this manner, if the short block length is selected, the number of samples in the orthogonal transform block in each band is selected to be the same so that time resolution will be increased and the number of sorts of the windows used for blocking will be decreased with increase in frequency. The block size information, indicating the block sizes as determined by the block determining circuits 19, 20 and 21 in the illustrative example of Fig.4, is routed to the adaptive bit allocation encoding circuits 16, 17 and 18 as later explained, while being outputted at the output terminals 23, 25 and 27. 9 800

In the adaptive bit allocation encoding circuits 16, 17 and 18 shown in Fig.4, the spectral data or MDCT coefficient data are re-quantized, that is normalized and quantized, depending on the block size information and on the number of bits allocated to the critical bands or the sub-bands further divided from the critical bands for higher frequencies. At this time, the adaptive bit allocation encoding circuits 16, 17 and 18 check the channel bit apportionment among the different channels, that is

the entire signals for the respective channels, for simultaneously effecting bit apportionment of optimally adaptively distributing the quantity of bits to the respective channels. The channel bit apportionment in such case is done based upon a channel bit apportioning signal supplied via a terminal 28 from an adaptive bit apportioning circuit as later explained. The data encoded in this manner are taken out via the output terminals 22, 24 and 26. The adaptive bit allocation encoding circuits 16, 17 and 18 also find the scale factor indicating the signal magnitude used as the basis for normalization and the bit length information indicating the bit length used for quantization. These information data are simultaneously outputted at the output terminals 22, 24 and 26.

The outputs of the output terminals 22 to 27 are combined together so as to be recorded on the motion picture film 1 of the present embodiment or on a disc-shaped recording medium as later explained. The recording is performed using a magnetic head or an optical head as recording means.

Referring to Fig.6, an illustrative construction and an operation of an adaptive bit apportioning circuit for bit apportionment among the different channels are explained in the embodiment of Fig.6, bit apportionment is done for eight channels in the same manner as for Fig.2.

In Fig.6, common portions of the respective channels are explained with reference to a channel 1 as an example. As for the remaining channels, the same reference numerals are used and the corresponding description is omitted for simplicity. An input information signal for this channel CH1 is supplied to an input terminal 31 for the channel CH1. The terminal 31 corresponds to the terminal 29 shown in Fig.4. This input information signal is developed by a mapping circuit 32 from a signal on the time domain to a signal on the frequency domain. If a titler bank is employed, time-domain samples are produced as sub-band signals. On the other hand, if orthogonal transform is effected directly or after filtering, frequency-domain samples are produced.

These samples are grouped by a blocking circuit 33 into plural samples as units. If the filter bank has been used, plural time-domain samples are grouped as units, whereas, if orthogonal transform is applied directly or after filtering, plural frequency-domain samples are grouped as units.

In the present embodiment, temporal changes of the MDCT time-domain input signals in the course of mapping are calculated by a time change calculating circuit 34.

The samples grouped into plural samples as units in the blocking circuit 33 are normalized by a normalization circuit 37. The scale factors, which are coefficients for normalization, are obtained by a scale factor calculating circuit 35. The tonality value is also found by a tonality calculating circuit 36.

The parameters thus found are used for bit apportionment in a bit apportionment circuit 38. If the number

of bits that represent MDCT coefficients and may be smaller value to larger values. Assuming that C bits are used for transmission or recording is 800 kbps for the available for this bit allocation in the eight channels, and entire channels, that is the above-mentioned eight channels, the bit apportionment circuit 38 of the present appearance transitions from smaller to larger values in the respecembodiment finds first bit apportionment including a sub-blocks of the respective channels are denoted that the channel bit allocation, that is bit allocation for the basic information; and second bit apportionment not including to tose that mayor be to apportioned evare to C\*a/Typ ≥C\*b/Te; read to channel bit allocation, that is bit allocation for the basic approximately allocation, that is bit allocation for the basic approximately allocation, that is bit allocation for the basic approximately allocation, that is bit allocation for the basic approximately allocation.

ing channel bit allocation is now explained? Bit allocation? Professional In Fig.8, only the channels CH1, CH2 and CH8 are is done adaptively in view of the distribution of the scale is an ashown, while the remaining five channels care motion of factors in the frequency domain. By teadight and of betake not ashown. The notember exit to equilibries out double to well by

In such a case, a effective obit fallocation may be in viber. achieved by effecting bit apportionment among the dif- 15 ing the channel bit allocation, is now explained: 15 ing the channel bit allocation, is now explained: ferent channels in consideration of the distribution in the channels: Considering that the signal information data listener, the masking effect may be assumed to operate on the sum of signals of the entire channels. Thus it is effective to perform bit apportionment so that the noise level of each channel will be equal for the same band, apportionment is achieved by the following equations: 400%

$$Bm \cong B^*(\Sigma SFn)/S$$

$$S = \Sigma(\Sigma SFn)$$

an approximate logarithm of a peak value. n is the block and se signal information (b) are employed. and navious as seen. floating band number in each channel, m is a channel and the Turning now to the tonality information, the sum of number and S is the sum of scale factor indices of the absolute values of the differences between adjacent entire channels. In: Fig. 7.5 only the charts for the chan- 40% signal spectral values divided by the number of the nels CH1 and CH8 are shown, while those for the ends spectral signals is employed as an index. Expressed

cuit 38 has a process of detecting time change charac-low so scale factors for block floating is employed. The scale teristics of the signals of the respective channels for 45% factor indices correspond to the logarithm of the approxchanging the channel-based amounts of bit allocation imate scaling factors. In the present embodiment, the by these characteristics as indices. These indices indicating the time changes may be found by the following (1) is set to a maximum of 80 kbps and a minimum of 10

in Figs.8A to 8H, each of bit allocating time blocks, who herein set uniformly to 100 kbps for simplicity. which are time units for bit allocation for information of the sec. The tonality is calculated by the following equation to the second input signals of the respective channels, is divided temporally into four time sub-blocks, as time units for bit allocation, and peak values of the respective time sub- 55 % blocks are found. Bit distribution among the respective where WLmax is the maximum value of the word length channels is done responsive to the magnitudes of the open equal to 16, SFn is the index value for the scale factor difference between the peak values of the respective and corresponding to the logarithm of the approximate peak sub-blocks when these peak values are changed from a standard result is the block floating band number.

that the magnitudes of the differences at the points of as a, b, c, d, e, f and g decibels (dB), the numbers of bits information polynoidis, till abbranched, at alample professional amagnitude of the signal information of argiven channel, to a The technique of the first bit apportionment includ- 10 is the more the number of bits apportioned to such chan-

The second bit apportionment scheme, not includ-

As the second bit apportionment scheme, not frequency domain of the scale factors of the entire including the channel bit allocation, the bit apportionment scheme comprising two bit apportionment of plural channels are mixed in the same sound field as a subschemes is explained. The second bit apportionment in the case of speakers to reach left and right ears of a 20% scheme corresponds to the bit allocation procedure by the adaptive bit allocation encoding circuits 16 to 18 などがけらかれつけって shown in Fig.4.

These two bit apportionment schemes are termed bit apportionment scheme(1) and bit apportionment as shown in Figs.7A and 7H. One of the methods for 25 scheme(2). In the following bit apportionment scheme, 85 scheme achieving this is to perform bit allocation proportionate and the bit rates that can be used for the respective chanto the magnitude of the scaling factor index. That is, bit seems are previously fixed for the respective channels. For the example, a higher bit rate of 147 kbps is used for a way a benisione you a noticeable to consechannel handling the crucial sound, such as speech. One of h. the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is allocated for a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other hand, 2 kbps at most is a channel 100 of the other h Pagern Latt Caught of groundered penisone a sense which is not crucial, and 100 kbps is allocated for the analy of should by  $S = \Sigma(\Sigma SFn)$  , which has a TOP for a particular similar formal sections as a section of the state of the section of the secti

TOOM AT TOS laminus tugnicis of basin it is shalf. The bit quantity employed for bit allocation schemes and where Bm is the amount of bit allocation for each channel, B is the amount of bit allocation for the entire chan- 35% information of the spectral information of the signal nels and SFn is a scale factor index and corresponds to 1000 sinformation (a) and the time change information of the

remaining channels are not showned has conscale years and more simply, a mean value of the differences between In addition to the above, the bit apportionment cire of the scale factor indices of the adjacent block-based process. 201 and attailed an account later of a contract of the kops in association with the tonality-indicating value. Assuming that there are eight channels, as shown 50 of the bits apportioned for the respective channels are

ដៅទាមស ១៩៦៧មានស្នាក់មាំព្រំប្រធា្

क्षा भाष्ट्र स्वतंत्र विकास स्वीतंत्र के स्वतंत्र ह

# $T = (1/WLmax)(\Sigma ABS(SFn - 1))$

information. T thus found are correlated with each other quency range, and the at an area of the second sec as shown in Fig.9 and is sound tendered to a enabling and it is

distribution ratio between the bit apportionment (1) and 3.5 (1) at least cone other bit apportionment to be annexed (1) § 30 thereto depends on time change characteristics of the information signals. In the present illustrative embodiment, the peak values of the signal information of users respective meighboring blocks are compared to one 500 another for each time interval obtained by subdividing the orthogonal transform time block size for finding the time area in which the amplitude of the information signals rise steeply. The ratio of bit apportionment (bit division) is determined based upon the state or degree of 15 steep rise in the signal amplitude.

The time rate of change is found by the following equations; accompages for least good your smears that

$$Vt = \Sigma Vm$$

## Vav = (1/Vmax)\*(1/Ch)Vt

being the entage that mean reades are out even where Vt is the sum of the changes from the smaller to the larger values of the peak values of the time sub- 10.25% caused by bit allocation for producing an acoustic effect the control of the peak values of the peak values of the time sub- 10.25% caused by bit allocation for producing an acoustic effect the control of the peak values of the peak value blocks of the respective channels, expressed in dB, and which is dependent on the frequency spectrum and the Vm is the largest one of changes from the smaller to the particle signal level. Side of the second s larger values of the peak values of the time sub-blocks and the life apportionment scheme not including of the respective channels, with the maximum value channel bit allocation is now explained. being limited to 30 dB and denoted as Vmax, expressed 30, 30. in dB. m denotes the channel number, Ch denotes the second this case is explained by referring to Fig. 13. The magninumber of channels and Vav denotes a change from a state tudes of MDCT coefficients are found from block to smaller to a larger value of the peak value of the time. \_ block and routed to an input terminal 801. The MDCT

tioned bits of the bit apportionment scheme (1) is ulti-

$$B = 1/2(Bf + Bt)$$

apportionment to the bit apportionment scheme (1), the set on noise with the aid of a certain proportion, herein 100 decided quantity of apportioned bits as found from Tva and the 45 kbps, of the total number of usable bits from a total usa-

dependent bit apportionment in the frequency domain rough the spectrum of the input signal, the higher is the

ment scheme (1) is determined in this manner, the bit apportionment scheme (2) for bits not used in the bit apportionment scheme (1) is determined. Various sorts of bit allocation are carried out. 1992 A Committee of the

First, bits are uniformly allocated for the totality of 55 sample values as more art to succe much a section can.

Fig.11 shows an example of the quantization noise ja ingo postoja o 1500 km iz 1

The number of apportioned bits and the tonality again noise level reduction is carried out for the entire free of

Second, frequency spectrum dependent and level In addition, with the present embodiment, the bit start dependent bit allocation is carried out for producing acoustic effects of the model and took about mention.

Fig.12 shows an example of the quantization noise spectrum for bit allocation in this case. In the present 5000 example, bit allocation dependent on the spectrum of site. the information signals is performed. Bit allocation is Advanced performed so as to put emphasis on the low range side of the spectrum of the information signals for compensating the decreased masking effects in the low range as contrasted to the high range. This is based on asymmetry of the masking curve and puts more emphasis on the low range in view of masking between neighboring critical bands. Thus the bit allocation is carried out so as to put more emphasis on the low range. And the second second

Finally, the sum of the bit apportionment (1) and the memorphicogs (id propertion) (Lamisian) as a super values of bit allocation to be added to the bit apportionenumenous Vt = ΣVm; adject of an iouser rule (20) ment (1) is found by the bit apportionment circuit 38 of β and su of 67 studio gribuore nucleaturs by extremos a Fig.6. Reserve of permusas ad year toace privisers son tour

In Figs.11 and 12, S, NL1 and NL2 denote the signal spectrum the noise level caused by uniform allocation to the totality, of samples, and the noise, level to be a

sub-blocks in dB, averaged over the channels. bendered as coefficients supplied to other inputs terminal 801; are 3 48 The time rate of change Vav thus found and the 35 routed to a band-based energy calculating circuit 803. quantity of bit, apportionment, (1) are correlated with as one The band-based energy calculating circuit. 803 calcu- 2 to a each other as shown in Fig.10. The number of apportunity lates the signal energy of each critical band and each sub-band divided from the critical band for higher fremately found by the following equation: at the sequential research quency. The band energy, calculated by the band-based e is to reconside one you become approved upon a percent calculating circuit 803 is supplied to an energy-time as beauting B = 1/2(Bf.+ Bt) bayon te chapter to a dependent bit allocation circuit 804. to six 340 bits 143

pageonal agunquable entition estate as we present the energy-dependent bit allocation circuit 804 per- மாக where B, Bf and Bt denote the ultimate quantity of bit see forms bit allocation of producing the white quantization quantity of apportioned bits as found from Vyantal periods as the bit generating circuit 802, herein 128 kbps. The programmer of the progr The bit apportionment (1) is the scale factor whigher the tonality of the input signal, that is the more and in the time domain, programmer of area of the second of above proportion in the total number of bits, herein 128 of the Once the quantity of bits employed for bit apportion- 50 kbps. For detecting roughness or non-smoothness of , the input signal spectrum, the sum of the absolute values of the differences of the block floating coefficients of neighboring blocks is used as an index. Of the total number of bits, thus found, bit allocation is performed in proportion to the logarithmic values of the band-based with a energy values. accept and group a movem visite at a formic can be star-

A bit allocation calculation circuit 805, performing spectrum for bit apportionment. In this case, uniformed to bit allocation in a manner dependent on the acoustically of the allowable noise spectrum, finds the allowable noise

, level for each critical band, in consideration of the solids the By this masking, any noise present in a masked portion called masking effects, based upon the spectral data in becomes inaudible. In actual audio signals, the noise distributed according to the critical bands, and allocates bits obtained by subtracting the energy-dependent bits  $\delta\omega \approx$ from the total usable bits for deriving the acoustically 5 ficients or filter coefficients of the respective multipliers allowable noise spectrum. The energy-dependent bits and the acoustically allowable noise level dependent multiplier M for an arbitrary band is 1, outputs of the bits are summed together and used for re-quantizing the spectral data or the MDCT coefficient data. The number of bits used for re-quantization is allocated by 100 ers M-1, M-2, M-3, M+1, M+2 and M+3, M being an arbi-1300 and M-3, M being an arbi-1300 and M-3, M being an arbi-1300 arbi-130 the adaptive bit allocation and encoding circuits 16 to 18 and trary integer of from 1 to 25, for performing convolution of Fig.4 (or Fig.3) to respective critical bands or sub-components SBart as testimanes a nation of a bands divided from the critical bands for higher frequen-make ac cies. The data, thus: encoded is outputted via the output to the transmitted to raisubtractor 524 which is employed for the contractor of terminals 22,724,426 of Fig.4. A list bettoeences action to 15 of

Turning to details of the acoustically allowable noise spectrum calculating circuit in the acoustically allowable noise spectrum dependent bit allocation calculation cir-129 cuit 805, the MDCT coefficients produced by the MDCT section as will be described subsequently. The subtractor circuits 13;:14; and 15; are:routed to the acoustically: 20

domain spectral data from the MDCT circuits 13 to 15 - 25 explained subsequently, thousand the province of a raised required or are supplied to an input-terminal 521ance inerm atheres are con-

The frequency-domain spectral data is transmitted to a band-based energy calculating circuit 522 in which 1987 and the energies of the critical bands and the bands divided from the critical bands are found by calculating the sum 30 30 total of squares; of the amplitudes; of the spectral compo- which where i is the number accorded sequentially to the criti-vients of nents in the respective bands. The amplitude peak val-  $\sim$  call bands beginning from the lower side,  $\underline{n}$  and  $\underline{a}$  are ues or mean values/may also be employed in place of the constants where a > 0 and S is the intensity of the conthe signal energy in the respective bands. Each spectral as the volved Bark spectrum. In the equation (1), (ni-rai) repre- ni some component indicating, the sum value of reach of the 0.35 sents the allowance function. As an example, n ≅ 38 € 55 € respective/critical/bands/ii/generally/ctermed/the Bark spectrum, its, indicated as SB- in Fig. 150/in-Fig. 15 bands B1;to, B12;are-shown as indicating the critical selection a divider 526 for deconvolving the level  $\alpha$  in the con-selection

spectral component SB by a pre-set weighting function and old becomes the allowable noise level. Although the same for taking into account the reffects of masking is oper- 17 22 deconvolution necessitates (complex arithmetic-logical (2.8 deconvolution) necessitates (complex arithmetic-logical (2.8 deconvolution)). formed by way of convolutions To this end, an output of sortin steps, it is performed in the present embodiment in a 2 big the band-based energy calculating circuit 522, that is each value of the spectral component SB, is transmitted 45% to a convolution filter circuit 523. The convolution filter. circuit 523 is made up of a plurality of delay elements for sequentially delaying input data, a plurality of multipliers, such as 25 multipliers associated with the respective bands, for multiplying outputs of the delay elements with filter coefficients or weighting functions, and an adder for finding the sum of the outputs of the respective multipliers. The masking means the phenomenon in which certain signals are masked by other signals and become inaudible due to psychoacoustic characteristics of the human aural sense. The masking effect may be classified into the time-domain masking effect produced by the time-domain audio signals and concurrent masking effect produced by the frequency-domain signals.

within the masked range is an allowable noise.

By way of a concrete example of multiplication coefof the convolution filter circuit 523, if the coefficient of a delay elements are multiplied by coefficients 0.15. 0.0019, 0.0000086, 0.4, 0.06 and 0.007 at the multipli-

An output of the convolution filter circuit 523 is 80% finding a level  $\alpha$  corresponding to the allowable noise level in the convolved region. Meanwhile, the allowable noise level α is such a level which will give an allowable noise level for each of the critical bands by deconvolu-24 is supplied with an allowance function (a function is allowable noise spectrum calculating circuit. en the base of the representative of the masking level) for finding the level and the Fig. 14 shows, in a schematic block circuit diagram, 1. 25 a. The level  $\alpha$  is controlled by increasing or decreasing an arrangement of a concrete embodiment of the allowable noise calculating circuit, in which the frequency-

> That is, the level a corresponding to the allowable asset to noise level is found from the equation (1): 19000 yillidib is mend olfaucosorfoyan Pansasiden sv. 🦠

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bands. Brancocks villaditations and bus notecody by the experience regional By athis deconvolution, the smasking of education It is noted that an operation of multiplying each 40 othershold is found from the level of. This masking threshsimplified manner by using the divider 526; and nemial to not a

The masking threshold is transmitted via a synthe-US similar and sizing circuit 527 to a subtractor 528 which is supplied 1914 at 1 in with an output of the band-based energy detection cira cuit 522, that is the above-mentioned spectral components SB. The subtractor 528 subtracts the masking 1986. 50. threshold from the Bark spectrum SB for masking the above. portions of the spectral components SB lower than the 🙉 blevel of the masking spectrum MS, as shown in Fig.15. (%) The delay circuit 529 is provided for delaying the Bark spectrum SB from the energy detection circuit 522 in 64000 55 consideration of the delay caused in respective circuits 

An output of the subtractor 528 is outputted via an second allowable noise correction circuit 530 at an output terminal 531 so as to be transmitted to a ROM, not shown, in information concerning the number of allocated bits for the equi-loudness curve also delineates a curve which the transfer of allocated bits for the equi-loudness curve also delineates a curve which the transfer of the equi-loudness curve also delineates a curve which the equi-loudness curve also delineates a curve also de each band, depending on an output of the subtraction circuit 530. The output is the level of a difference between the band-based energy and an output of the noise level setting means. We believe the amount is another with

The lenergy-dependent bits and the acoustically 2700 allowable noise level dependent bits are summed 10 10 kHz cannot be heard with the same loudness as the same together and the corresponding allocation bit number information is transmitted via the terminal 28 of Fig. 4 to the the adaptive bit allocation and encoding circuits 16 to 18 where the frequency-domain spectral data from the MDCT circuits 13 to 15 are quantized with the numbers 15 characteristics represented by a curve conforming to of bits allocated to the respective bands. They exceed an localist

In sum, the adaptive bit allocation and encoding circuits 16 to 18 quantizes the band-based spectral data and the equi-loudness curve is in conformity to psychoawith the numbers of bits allocated depending on the BE of coustic characteristics of the human aural sense of the human aural sense of the human aural sense. level of the difference between the output of the noise 20 % level setting means and the peak or energy values of accomplevel dependent spectral configuration is produced by allow the critical bands or the sub-bands further divided from the critical bands for higher frequencies. Responsi sons with a

to synthesize the masking threshold MS; and data at 25 and denoting the minimum audibility curve RC from the minimum audibility curve generating circuit 532. The mini-vector in the second sec mum audibility curve represents psychoacoustic characteristics of the hearing sense as shown in Fig.16. If the absolute noise level is lower than the minimum 30 marked difference in the manner of the music entering 1935 or calculated as indicating spectral smoothness as about inspectra the 16-bit dynamic range in actual, digital systems, it 🕞 a D 🕾 may be presumed that if the quantization noise of the frequency range in the vicinity of 4 kHz most perceptible and a cuit 809 where the bit division ratio between the energy distribution of the control of the to the ear is not heard; the quantization noise lower than the dependent bit allocation and the acoustically allowable the level of the minimum audibility curve is not heard in \$140 \$ noise spectrum dependent bit allocation is found. In any other frequency range. Thus, if the recording/ reproducing device is employed so that the noise in the vicin- year-larger the output value of the spectral smoothness cality of 4 kHz is not heard, and the allowable noise level is a least culating circuit 808, the lesser the spectral smoothness. to be obtained by synthesizing the minimum audibility satisfy Based on this assumption, bit apportionment is so that a curve RC and the masking spectrum MS, the allowable 145 made that more emphasis is put on the bit allocation 100 100 noise level may be up to the level indicated by hatched to the dependent on the acoustically allowable noise spectrum to the lines in Fig.16: In the present embodiment, the level of 4 than on the energy dependent bit allocation. The bit divikHz of the minimum audibility curve is matched to the find a sion ratio decision circuit 809 transmits control outputs minimum level corresponding to e.g., 20 bits. In Fig.16, and to multipliers 811, 812 designed to control the propor-

teristics of hearing sense, and is obtained by finding the sound pressures of the sound at the respective frequen- summed together by an adder 806 to give the ultimate cies heard with the same loudness as the pure tone of 1 and 2

which the information concerning the number of the property and by connecting the sound pressures by a curve, at the allocated bits is stored previously. The ROM outputs the also known as an equal loudness sensitivity curve. is substantially, the same as the minimum audibility our circuit 528 supplied via an allowable noise correction 55 curve shown in Fig.16. With the equal-loudness curve, the sound in the vicinity of 4 kHz is heard with the same deavers loudness as the sound of 1 kHz; even although the district sound pressure is decreased by 8 to::10 dB from the sound of 1 kHz. Conversely, the sound in the vicinity of seasons sound of 1 kHz unless the sound pressure is higher by alto 8 about 15 dB than that of the sound of 1 kHz. Thus it may be seen that the noise exceeding the minimum audibility is above. curve (allowable noise level) preferably has frequency the equi-loudness curve. Thus it may be seen that correction of the allowable noise level in consideration of

The above-described acoustically allowable noise bit apportionment employing a certain proportion of the total usable bits, herein 128 kbps: This proportion is 65% The synthesizing circuit 527 may also be designed with increase in tonality of the input signal and the control of the control of the input signal and the control of the control

The technique of bit quantity division between the two bit apportionment schemes is now explained or basic to the

Returning to Fig. 13; the signal from the input terminal 801 fed with the output of the MDCT circuit is also have a -fed to a spectrum smoothness calculating circuit 808 14 14 24 where spectral smoothness is calculated. In the present which audibility curve RC, the noise becomes inaudible. The test embodiment, the sum of the absolute values of the different but minimum, audibility curve differs with the difference in the differences between neighboring values of absolute values and absolute values of absolute values and absolute values of absolute value value values of absolute value value values of absolute value valu the playback sound level even although the coding is as the ues of signal spectral components divided by the sum of made in the same-manner. However, since there is no a beginning the absolute values of the signal spectral components is now a

An output of the spectral smoothness calculating has as circuit 808 is also fed to a bit division ratio decision cirthe signal spectrum SS is also shown. Fig. 1. 20 to 1. 20 Besides, the allowable noise correction circuit 530 and acoustically allowable noise spectrum dependent bit corrects the allowable noise level in the output of the anallocation. If the spectrum is smooth and an output of subtractor 528 based on the information of the equiloudness curve transmitted from a correction information value of 0.8 in order to put more emphasis on the tion outputting circuit 533. The equi-loudness curve is a 1.55 all energy-dependent bit allocation; an soutput of the bit of characteristic curve concerning psychoacoustic charac-array division ratio decision circuit 809 to the multiplier 812 is set to 1-0.8 = 0.2. Outputs of the two multipliers are

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bit allocation information which is outputted at an output terminal 807.

Figs.17,18 and Figs.19, 20 show the bit allocation and the corresponding quantization noise, respectively. Figs.17 and 18 show the bit allocation for a smoother of the At this time, scaling factors are produced as coefficients of the scaling factors are produced as coefficients of the scaling factors are produced as coefficients. signal spectrum and for a signal spectrum exhibiting. Xiii. Indicating the extent of block floating enrices with a high tonality, respectively. In Figs. 17,918; QS and QN 75 flour. A first quantizer 901 of the next stage carries out of the ent bit allocation and noise reduction by the acoustically an arche first quantizer 901 is the basic information and noise reduction by the acoustically an arche first quantizer 901 is the basic information and noise reduction by the acoustically and arched first quantizer 901 is the basic information and noise reduction by the acoustically and arched first quantizer 901 is the basic information and noise reduction by the acoustically and arched first quantizer 901 is the basic information and noise reduction by the acoustically and arched first quantizer 901 is the basic information and noise reduction by the acoustically and the first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic information and arched first quantizer 901 is the basic part of the basic part of the properties of th allowable noise level dependent bit allocation, respective to a Outputs of the normalization circuit 905 and their node.

to-noise ratio which is higher for the entire frequency and somalization circuit 906 to a second quantizer 903.6. Poisson of range. However, smaller numbers of bits are used for each

the decrease in the quantization noise is utilized for low-search tizer 903 is 2\*No. 111 (87) of local garboned (78) box 3-0 (80) ering the noise of an extremely narrow band. The conscious research the second quantizers 903% effects bit rallocation is second. dependent bit allocation is less stringent. A lampb (Bit) (1975)

improved characteristics of a lone spectral input signal, and ne first quantizer 901, is the supplementary information to be seen as as shown/intFight3.et illugar entranchi alembis oldus listig/mic 35

are carried out in the following manner with the aid of some stionment including channel bit allocation are divided into section. the bit apportionment not including channel bit alloca- a bit apportionment portion not more than 128 kbps and 4000 cares a bit apportionment portion not more than 128 kbps and 4000 cares a bit apportionment portion not more than 128 kbps and 4000 cares a bit apportion not more a bit apport tion and the bit apportionment including channel bit allo-{.. because close to 128 kbps as possible and a remaining bit were an

the eight channels to which bit allocation exceeding 147, beforekbps are provided is as follows. Since the remaining bit allocation exceeding 147, beforekbps are provided is as follows: bit allocation rare the channel CH1, channel CH3 and 30 distinformation indicating the word length of 47 kbps is set onto

subjected to normalization with respect to blocks for plural samples, that is to block floating. At this time, the

In Fig.22, an MDCT coefficient (MDCT sample) supplied via an input terminal 900 to a normalization cire cuit 905 where block floating, that is block-based normalization, is carried out with plural samples as a unit. of the samples as a unit. of the samples as a unit.

denote the signal level dependent bit quantity and the specifiquantization with leach sample word lengths of the bit see acoustically allowable noise level dependent bit quan-noise apportionment not including the channel bit allocation Sager and tity, respectively. In Figs. 19, 20, L/NS and NNtdenotes: 10 CAt this time, quantization by round-off is carried out for the last the signal level/moise reduction by signal level depends a forreducing the quantization noise. A quantized output of entitles

of awards colemand evil result of the assistance of the properties of the second of th Referring first to Fig.17-showing a smoother signal and the difference between the input and the output of the research spectrum, withe fracoustically allowable unoise wevel to a quantizer 901, that is a quantization error, is found: Answer dependent bit allocation is useful for achieving a signal- of the difference unit 902 is transmitted via a nor-second

The second quantizer 903 employs, from sample to was an lower and higher frequency ranges because of low-sensor length of a difference between seach nonzero sitivity of the thuman ear to these frequency ranges. I sample word length of the bit apportionment including the con-Although the quantity of bit allocation dependent on the treath the channel bit allocation and each sample word lengths signal energy level is small, more emphasis is put on the analysis of bit apportionment not including the channel bit alloca-to proceed mid to low frequency ranges having high signal levels in 1000 bition. The floating coefficient at this time is automatically order to produce a white noise spectrum. As industributed a determined from the world length and the floating coeffice serious On the/other hand/if-the signal spectrum exhibits areas cient employed in the first quantizer 90.10 That is if the base of a high tonality, as shown in Fig.18, the signal energy level recreaword length employed in the first quantizer 901 is Nibits; a near content of the first quantizer of the first quantize dependent bit allocation becomes prevalent, such that the floating coefficient employed in the second quanter noince

centration of the acoustically callowable noise slevel no continuing round-off in the same waysas the first quanter of the tizer 901. A quantized output of the second quantizer education. The sum of these two bicallocation sorts results in 1,200,903, that is the quantization error information from the 200

Thus the bits of a channel to which bits exceeding and the The first:quantization and the second:quantization (1996) 91.47 kbps:have.been:allocated by the channel bit apport 295009 cation realized as described above, for a mora of the region 40 phappointment portion of additional exects both indicate the manual cation realized as described above, for a mora of the region 40 phappointment portion of additional exects both indicates.

Reference is had to Fig.21. The channels among with both. The reason two thresholds of a 128 kbps and 147 of the channels. kbps is done by the bit apportionment including channel apportionment portion is also in need of the subsidiary the channel CH7. bits to the total of the following representative as the minimum quantity, which permits bit allocation of the channel CH7. bits to the channel CH7. bits Each channel for which the bit allocation including a data region inclusive of the subsidiary inforthe channel bit apportionment exceeds 147 kbps is the smatter. If the bit apportionment quantity including the same divided into a portion having a certain bit quantity, such a channel bit allocation exceeds 128 kbps and is lower as 128 kbps, as a maximum value, and a portion subthan 147 kbps, only the subsidiary information can be exceedings128/kbps./sear/screecings.come.go.s.dictions/dictions/diction (written in the data) portion; exceedings 128-kbps; such dictions Fig.22 shows an illustrative construction of a circuit of that there is no room for writing the sample information; Society employed forethis purpose. 157/10/10 (147/4700) In the reason, the above In the construction of Fig:22, respective samples of \_\_\_\_\_ value of 128 kbps is set so that, for such channel, bit the bit apportionment scheme, in which the bit:allocation including bit apportionment exceeds 147 kbps, are 55 will be smaller than 128 kbps and as close to 128 kbps

As for the channel for which bit apportionment scaling factor as a coefficient indicating the degree of the including the channel bit allocation is smaller than 128 and block floating is obtained. kbps, such channel bit allocation is directly employed.

As for the magnitudes of the components of the low remaining bit apportionment portion, is since the scale below to factor can be calculated from the word: length and the 200 / 10 scale factor of the bit apportionment (1)p as shown increase according to the channel sequence. Next, the fractions was the Fig. 22, only the word length is required by the decoder of a first of channels exceeding at 47 kbps; including the channel of the channel of

of Fig.22,9 denormalization scircuits (908):1907:care pro-citingus Although, the number, of channels is eight in the citation vided for coarrying out denormalization (in) connection at 10% above-described embodiment, it may also be five, an (20% ). with the operation carried out by the normalization cir-guides which case the channels in Fig. 2 are comprised of a left region to cuits 905, 906, respectively. Outputs of these denormal presidencenter channel, a center channel par sub-woofer channels and the ization circuits 908,4907 are summed together by angle nel, a right channel, a sumound left channel and a sure disperse adder 904; a sum output of which is taken out at an out-oxides round right channel. For these five channels, shown in well a

decoding circuit-which is a counterpart device of the assessing channel gallocation canda bit capportionments not counterpart compression encoding acircuits shown in a Fig. 4: The assessincluding channel bit allocation in the following manner was a compression of the comp expansion decoding circuit of Fig.23 decodes the compression coded signal for one of respective channels (20) aformed as shown in Fig. 24.6 In the case of Fig. 24.6 the read out from the medium of the present embodiment, elign channels among the eightschannels in which bit apports with medium of the present embodiment. by e.g., a magnetic/head or anapptical/head as repro-assis ationment exceedings147 kbps is:done by bit/apportion-nguera

for the respective bands are fed to input terminals 122; and 25% bit allocation, such as channel (CH 6 of) Fig. 24% or the, of the control of 124 and 126 of the decoder, while the block size information and channel 8 of Fig.21, may be exemplified by the above-to-0. mation and the information on ladaptive bit allocation as to ementioned sub-woofer channel; (8) and in owork as left to the control of the co which have been employed are fed to sinput terminals about self. An illustrative construction of asmodification of asmost 123, 125 and 127. Decoding circuits 116, 117 and 118 009 to compression encoding, circuit reflecting bit apportion and the cancel bit allocation, using the information on the adap- # 30 ment among respective channels is shown in Fig.25 pinent group tive bit allocation; and effects expansion and decoding graph which only one channel is shown; also are in the arcite area using the block-size information to sugton beginning A 2000 result. In Fig.25, digital audio-signals of only one-channel store con-

quency-domain/signal/into:the-time-domain/signal/. The 1990 is to an input terminal/301#0eca enc. in he abitaneous and bayona of time-domain signals of the partial frequency ranges are 35 decoded in a IQME circuits of 12 and at 111 cinto a full-range of the temporarily stored and a buffer 302 from which data and

quantity exceeding 128 kbps in the channels where bit apportionment (1) with 128 kbps of bits or less including the enmodified discrete sine transform (MDST) and discrete sine transform (MDST) are discrete sine transform (MDST) and discrete sine transform (MDST) are discrete sine transform (MDST) and discrete sine transform (MDST) are discrete sine transform (MDST) and discrete sine transform (MDST) are discrete sine transform (MDST) and discrete sine transform (MDST) are discrete sine transform (MDST). the channel-bit-allocation and bit-apportionments(2) The coefficient data from the orthogonal transforms are as the

block.

- than 147 kbps, including the channel bit allocation, 455 dec. The adaptive quantization circuit 305 is fed via a control of the channel bit allocation, 455 dec.
- (ii) the fractions of channels exceeding 147 kbps, ( ...

a certain bit quantity, such as 128 kbps, is the max-soulis with

Figs 17, 18 and Figs 19, 20 show the bit allocation In this manner, rounded highly efficient quantized allocation; in each of which a certain bits quantity, a largest outputs may be produced by the quantizers 901, 903. Each is such as 128 kbps, is exceeded are arrayed in the chan-not do a In a décoderpas a counterpart; unit for the éncoder establishenel sequence, a visit sup tid training ab laval tanger en la fort p

put terminal 910...chile em sua luqui em neewisd sons em se Fig.24, the first quantization, and the second quantization Fig.23\ shows the construction: of an expansion acception are carried out using the bit apportionment includ-matter as

The bit allocation for the five channels may be perducing means, slid tenns to entignibulari ton instruction or or ment including channel bit allocation are channels CH1 as tonce Referring to Fig.23, quantized MDCT coefficients of the and CH3. The channels with smaller number of bits of each bit.

IMDCT:/circuits:113p1114 and:/115:convertathe-fre-to-% @among plural-channels:of-the-basic information are fed editional and and another section and another section are fed editional and another section and another section are fed editional and another section and another section are fed editional and another section and another section are fed editional and another section and another section are fed editional another section and another section and another section are fed editional another section and another section and another section and another section and another section are section as a section and another section are section and another section and another section are section and another section and another section are section and another section and another section are section as a section and a section are section as a section are sect

The digital audio signals from the input terminal 301 media and signals. One belove are noticed the many gributors from rare taken out as data blocks each consisting of N points are expensed to In the expansion decoding circuit, those fractions of a scor N samples; with neighboring samples being over a secon N samples; having the pre-set bit quantity, such as 128 kbps, as the sales lapped by 50% The block-based data are transmitted to the sales lapped by 50%. The block-based data are transmitted to the sales lapped by 50%. maximum bit quantity and those fractions having the bit 1940 can orthogonal transform circuit 303 so as to be orthog-101100 in onal-transformed by the above-mentioned MDCTs and 365

exceeding 1.47 kbps including the channel bit allocation some circuit 303 are compressed by a sub-band block floating spoke 1.2 are carried out are decoded by the decoding circuits out a point compression circuit 304. The coefficient data that cases a b 116, 117 and 118. At this time, the two fractions of the are satisfithe basic information; from the sub-band block float-ross? channel bit apportionment (2) are decoded and subseting point compression circuit 304; is fed via a terminal notice quently the respective samples are summed together to the respective channels a bening the respective channels are benefit to be a simple channel are benefi give highly accurate samples visible due en vice learning in shown in Fig.26 to a log spectrum envelope detection. As for the manner of arraying the resulting data of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while being also fed to an adaptive quantizas of 6.50 discircuit 322, while 6.50 discircuit the respective channels, there are arrayed; in a synchronic tion circuit 305 along with the supplementary information of the synchronic tion circuit 305 along with the supplementary information of the synchronic tion of the synch evenue and representation apartment apartment and control of the subsidiary information (compression responses த்தி அன்ற நடுத்து அரச்சு நக்கிய இது இது இது இது இது முற்ற கும் conversion coefficient information) from the circuit 304,5 இத (i) channels where apportionment of bits with less of the such as the word-length information or scaling factors of a local end of the such as the word-length information or scaling factors of a local end of the such as the word-length information or scaling factors.

grow or terminal 321/ associated with reach/ channel and via a 1945/00 terminal 321 of Fig.5 with the bit allocation information including the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of the channel bit allocation, in each of which the state of Languages with the control of the state of the common that the channel-to-channel bit apportionment based of the upon the envelope information detected by a spectral envelope detection circuit 322. The adaptive quantization circuit 305 adaptively quantizes the subsidiary information and the coefficient data of each channel based upon the channel-to-channel bit apportioning information. The adaptive quantization circuit 305 outputs an adaptive quantization output (quantization conversion coefficient information) and the bit allocation information. These outputs of the adaptive quantization circuit 305 are routed to the above-mentioned multiplex insert 1070 frame synchronization and error correction circuit 306.15

The multiplex insert frame synchronization and error correction circuit 306 multiplexes, for each channel, the adaptively quantized coefficient data and the subsidiary information (quantization conversion coefficient information) and the bit allocation information, adaptively quantized for each channel, and appends an error correction code to the multiplexed data, while processing the resulting data with insert frame synchronization for recording the data in e.g., the recording area 4 of Fig.1: An output of the multiplex insert frame synchronization and error correction circuit 306 is the compression encoded output of each channel. State of the state of the pression encoded output of each channel.

An illustrative construction of an expansion decoding circuit as a counterpart device of the compression 25 encoding circuit of Fig.25, is shown in Fig.27, in which only one channel is illustrated. That is, the expansion decoding circuit decodes the compression encoded digital audio signal from each channel. more made in the

In Fig.27, the high efficiency:compression encoded a 30 digital audio signal is fed to an input terminal 210. This tiplexing and error correction for the first area by a frame synchronization demultiplexing error-correction-circuit - these is take to the sear the should make her. TO that asset to the motion picture film.

The frame synchronization demultiplexing error cor- not accorrection circuity211 outputs the adaptively quantized visits is routed to a quantization step size control circuit 213. 40 upon the quantization step information from the quantization step size control circuit 213. The quantization compression conversion coefficients from the adaptive 45. dequantization circuit 212 are fed to a sub-band block floating point expansion circuit 214.

The subband block floating point expansion circuit 214 performs an operation which is an inverse operation of that performed by the subband block floating point compression circuit 304 of Fig.25. An output of the expansion circuit 214 is transformed into N-point sample data by an inverse orthogonal transform circuit 215 which performs an inverse operation of that performed by the orthogonal transform circuit 303 shown in Fig.25. The N-point sample data are fed to a window:overlap circuit 216 where the overlap is canceled for outputting of PCM audio signals which are outputted at an output terminal 216.:--: Contraction and arms

The above-described compression encoded digital audio signals of the respective channels are recorded on the motion picture film 1 shown in Fig.1d. That is, the compression-encoded digital audio signals of at least the left channel, center channel, right channel, surround a day to left channel, surround right channel and the sub-woofer channel are recorded in the first regions 4 between the perforations: 3@ of @ Fig.1d; While @ the @compression .... encoded digital audio signals of at least the left center channel, right center channel, mixed left channel, center channel and the mixed right channel are recorded in the longitudinal second region 5 of Fig.1d? The audio signals of the multiple channels in their entirety are preferably recorded with overlap in the first and second regions. From he alced and to grund the lat philodogy year

Thus, even if the motion picture film of the present embodiment is severed during editing thereof, the digital audio signals of the respective channels may be restored using the information recorded in the first regions 4 between neighboring perforations 3 or in the longitudinal second region 5. Above all, if the first regions 4, in which the basic information is recorded, is severed, data of the center channel, left channel, surround left channel, right channel and the surround right channel may be regenerated using data of the center channel, mixed left channel and the mixed right channel recorded in the second region ( Taut) for the setting testing . .

Although the motion picture film is given as a second medium in the above-described embodiment, the discshaped recording media, such as an optical disc, magneto-optical disc, a phase-transition optical disc or a source signal is processed with frame synchronization, demul- a magnetic disc, for a tape-shaped recording medium, as the such as a magnetic tape may also be employed as the recording medium of the present invention, in addition as a large

Recording on the disc-shaped recording medium is 11 effected as shown for example in Fig.28. That is, in the quantization conversion coefficient information and the Sease Fig.28, a recording track 91 provided on an information to the Sease Fig.28. bit allocation information. The bit allocation information recording area 92 on a disc 90 is divided into a record. ing area V for recording the second information and a second informatio The adaptive dequantization circuit 212 dequantizes the proceeding area. A for recording the first digital information in quantization conversion coefficient information based ... . a tion. The second information recorded in the recording and a second information recorded in the recording area V and the first digital information recorded in the recording area A may be exemplified by e.g., the picture # 1.55 information and the sound information, respectively. 10 10 10 10

The recording medium of the present invention may also be a transmission medium, in addition to the more recording medium as described above. An example of the transmission medium is a communication network. in which case the communication frame is divisionally with employed by the second information and the first digital 40.000 information. In case of packet communication, for example, each packet is divided into the second information and the first digital information. If, in case of employing a transmission medium, bits are allocated among plural channels, bit allocation is done among communication packets and communication frames of plural channels corresponding to plural bands divided from the transmission frequency spectrum.

, With the above-described information processing method of the present embodiment and the information efficiency encoded information, variably allocating bits and processing apparatus of the present invention, since the second time-domain, samples, and frequency-domain, same second time-domain, same second tim first digital information is encoded and arranged in plural security ples of the basic information and the subsidiary informaregions proximate to the information region in which the 115 section among the different channels and by setting the second information on the motion picture film 1, disc 90 and a total bit apportionment for the respective information of ral regions on both sides of the information region in second stant. This may be achieved by resolving the bit apportunity which the second information is arranged, the second season tionment to channels to which more bits than a pre-set as a tion may be achieved using the subsidiary information.

and the second information of the present embodiment bit allocation for the subsidiary information including the include the sound information, the present embodiment channel bit allocation and the bit apportionment for the may be applied to a variety of equipment handling 20 basic information not including the channel bit alloca-

method of the present embodiment and the information ence between sample data obtained from bit apportionprocessing apparatus of the present invention, since the second ment including channel bit allocation and sample data basic information is comprised of quantized samples, 25 obtained from bit apportionment not including channel and the subsidiary information is comprised of the re- party bit allocation, whilst the scale factor for sample data of quantized samples of the quantization errors of the subsidiary information may be found from the word basic information, it is possible to improve the signal-tonoise ratio in encoding and decoding the basic information. tion. Also, assuming that the basic information is the 130 sets. In the present embodiment, the same quantization information of a lower frequency range than that of the consist carried out for respective sample data-in-small-sized subsidiary cinformation; it is possible to improve the blocks sub-divided along time and frequency. The samsound quality of the acoustically critical low frequency; as sople data in the mini-block are produced by effecting range signal if the basic information is e.g., the sound proceed blocking frequency analysis by orthogonal transform, information.

disc-shaped recording medium or a communication network. If the pre-set medium is a motion picture film, the signal decoding of the sample data: may raiso be save area of the motion picture film other than the picture of the motion picture film other than the picture of the motion picture film other. recording area 2 may be effectively exploited by using 40 by QMF during encoding and non-blocking frequency the recording areas 4 between the perforations 3; trans-personant substances by a QME, during decoding. With the present areas versely aligned recording areas 4 between the perfora- set a sembodiment, the frequency bandwidth of the non-block-set aligned recording areas 4 between the perforations 3 on both sides of the film 1, longitudinal recording. Visiting frequency analysis may be equated for at least-two area 5 between the perforations 3 and the edge of the perforations and set so as to be broader with a so film 1, longitudinal recording area 4 between the film 45 cincrease in frequency for matching to the psychoacousedge and the perforations 3 or the recording areas 4 between the perforations 3 as plural regions for the first seems blocking frequency analysis, the block size is adaptively. digital information. On the other hand, by separately changed to e.g. a long mode or a short mode, and such a arranging the basic information and the subsidiary information in the recording regions 4 between the perforations 3 of one of the rows of the perforations 3 and in the leave equency analyses for assuring frequency analyses conrecording regions 4 between the perforations of the same forming to characteristics of the input signals. Situation recording the region for the basic information and the region for the characteristics of the input signal is achieved as the the subsidiary information and to increase the amount #55 by changing the sum of the bit apportionment portion of

of bits by arraying the multi-channel sound information is the second independence upon the maximum sample magnitude of as the first digital information, compressing the basic to the scaling factors of the respective channels, chang-

information and the subsidiary information as the high and a or on the communication network is arranged or in plu-source data to the totality of the channels substantially coninformation and the first digital information may be cor- 1000 reference quantity are allocated into a bit quantity fracrelated with each other as to the positions thereof on the losses tion for the basic information and a difference bit quantity of medium. On the other hand, since the first digital infor-to-activity fraction, and by effecting variable bit allocation of mation has not only the pre-set basic information but the avarious samples of the plural channels among the differalso the subsidiary information for the basis information, ent channels. The bit quantity fraction for the basic inforhigh-quality encoding or decoding of the basic informa- 115 mattion is a bit apportionment not exceeding the pre-set reference quantity at most and the difference bit quan-In addition, since both the first digital information tity fraction corresponds to the difference between the sound signals and the several decreases become landard tion. The sample data concerning the bit apportionment With the above-described information processing for the subsidiary information can be given as a differlength and the scale factors for the sample data of the object - ३.१ मण अदवद्या क्रिक्टा channet

ുങ്ങ് ഒരുക്ക് അക്ക് 35ൻ such as MDCT, for each block composed of plural sam-The pre-set medium may be a motion picture film; a ples, during encoding; and by blocking frequency syntic characteristics of the human auditory system. For the  $\mathbb{R}^{2\times 2}$ 

of the recordable information was some or acute to be no contractive basic information of the respective channels and the contractive channels and the contractive channels and the contractive channels. In addition, it is possible to make effective utilization and addition apportionment portion of the subsidiary information ing the channel-to-channel bit apportionment by chang- 😌 💀 tion is the quantized sample- and the subsidiary 🕬 🔻 ing the time change of the channel-to-channel scaling the information is the re-quantized sample of the quantizafactors for changing the channel-to-channel bit apportionment or by changing the time change of the chan-sign sprimprove the signal-to-noise ratio in the encoding and the signal-to-noise ratio in the signal-to-noise nel-to-channel scaling factors for changing the channel- 5 decoding of the basic information. In addition, if the

present embodiment, each sync block is divided into a seaso information is the sound information may be improved in seasons group of samples of the bit apportionment of the basic apparatus quality. Here and vorceupe the world because the bit apportionment of the basic apparatus quality. information apportioning the bit quantity exceeding a 10 % The pre-set medium may be a motion picture film, pre-set medium so that the bit allocation sample groups the basic information and the subsidiary information and may be decoded and reproduced even if these sample and between perforations of one of the rows of perforations groups are alternately recorded on the channel basis. It was and between perforations of the other row of perforais possible with the decoding means to detect the chan- 1925 Otions. nel having a bit quantity exceeding the pre-set reference to below In addition; laccording to other present invention; quantity since the bit apportionment quantity to the missise effective bit utilization may be achieved by arraying the channel is set so as to be larger than onequal to the ref-bessic multi-channel sound information as the first digital inforerence quantity of the subsidiary information smaller at the mation, compressing the basic information and the sub-19 received than the pres-set reference quantity.

information encoded by the information processing method or the information processing apparatus of the Fig. A present invention are arrayed and the area utilizable for such arraying is effectively utilized for improving the 35 quality of the arrayed information, in that end gnibes to

It is seen from above that, with the information processing method and apparatus of the present invention, since it is possible to encode the first digital information and the cencoded first digital information is arrayed in plural regions proximate to the information region on the pre-set medium in which the second information is arrayed and in plural regions on both sides of the information area in which the second information is arrayed, the second information and the first digital 45 information may be correlated as to the position thereof on the medium. On the other hand, since the first digital information has not only the pre-set basic information but also the subsidiary information of the basic information, it becomes possible to effect encoding and decod-1150 ing of the basic information using the subsidiary information with high:quality:b goods some lost both, in Ad-

On the other hand, since the first digital information contains the sound information; and the second infor-condimation also has the sound information, the present 55 invention may be applied to a variety of equipment handling the sound. In 15th at 17th 12 Daniel 18th A. 1 mails to 2 prove

With the information processing method and apparatus of the present invention, since the basic informa-

to-channel bit apportionmental to noige (grabitope) and tricking basic information is e.g.; the sound information, the low to accompany to With the information processing apparatus of the state frequency range which is acoustically crucial if the basic

pre-set reference quantity for plural schannels and recording medium or a communication netanother group of samples of bit apportionment of the work. If the pre-set medium is a motion picture film, the remaining subsidiary information and the information acres plural regions for the first digital information may be thus split is recorded; occasionally alternately, or the regions between different perforations, between aligned pre-set medium by a magnetic head or an optical head of 15 operforations on both sides of the film, between the peras recording means. The expansion decoding circuit of the forations and the film edge, between the perforations the information processing apparatus of the present want the film edge and between perforations, for effecembodiment is designed to effect decoding and reproduction from the bit allocation sample groups of the motion picture film. In addition, the basic information and subsidiary information recorded 20 regions for the basic information and the subsidiary in separation from each other in one sync block on the information may be obtained by separately arranging

sidiary information as the high-efficiency encoding to the With the medium of the present embodiment, the Missinformation, evariably apportioning bits for time-domain. or frequency-domain samples of the basic information and the subsidiary information among plural channels (1976) and and by setting the total bit apportionment quantity for the entire channels of the sum of the bit allocation quantities for the respective information data so as to be substantially constant a This may be achieved by resolving a resolving the quantity of bit apportionment the channels; to which  $\mathcal{O}(\mathcal{O})$ a bit quantity exceeding a pre-set reference quantity is to be apportioned, into a bit quantity portion of the basic - tree information which is the bit allocation not including the acchannel bit allocation not exceeding a pre-set constant quantity at most, and a bit quantity portion equal to a difference between the bit apportionment not including the channel bit allocation of the basic information and bit apportionment including channel bit allocation bit as bit apportionment for the subsidiary information, and by effecting variable bit apportionment of the samples of the plural channels among different channels. The sample data concerning bit allocation to the subsidiary information may be given as the difference between sample data derived from bit apportionment including channel bit allocation and sample data derived from bit apportionment not including channel bit allocation, while scale factors for sample data of the subsidiary information may be found from the word length and the scaling factors for the sample data of the basic information.

> In addition, according to the present invention, the same quantization is carried out for sample data within

quency. The sample data in the mini-blocks are produced by effecting pre-set blocking frequency analyses as subsidiary, information smaller than the pres-set referfor each block made up of plural samples during encode opening ence quantitys and to equally emit and gragostic added them are to ing and by effecting pre-set blocking frequency-synthe-gasters. It is seen from above that, according to the present of the sense. For non-blocking frequency analyses and for 1850 recorded in one of the regions is lost open and the regions are recorded in one of the regions in the regions are recorded and the recorded and t blocking frequency analyses, polyphase quadrature file and the Next, with the medium of the present invention, the constant invention in the constant in the constant invention in the constant invention in the constant in the constant invention in the constant in adaptively changed depending on the time characteristy agonation of the arrayable region declaration because in the characteristy signals.

portion of the basic information and the bit apportion to measure the encoded information is arrayed in the vilingue some. ment portion of the subsidiary information to the respection 30 store tive channels oins dependence auponouthe \maximum valure oclaims on the members and and to make am artiful of sample magnitude or the scale factors of the respective and at the channels, achanging the channel-to-channel bit appored and of a method for processing the information comprises because tionment by:time:changes of the amplitude information and and a ing. not aldeside was a dit bas because as a concever task are of peak or mean values or energy values of information (1935) signals of the respective channels or by changing the contact time change of the channel-to-channel scaling factors who have for changing the channel-to-channel bit apportionment

With the information processing apparatus of the 1800 ac present embodiment, each sync block is divided into a 40 group of samples of the bit apportionment of the basic and a information:apportioning the bit quantity exceeding ad least pre-set reference quantity for plural schannels and a class another group of samples of bit apportionment of the amount remaining subsidiary; information; and the information : 45: thus split is recorded, occasionally alternately, conthe not see. pre-set medium by a magnetic head or an optical head reacces as recording means. The expansion decoding circuit of general 2. the information processing apparatus of the present access embodiment is designed to effect decoding and reproduction from the bit-allocation sample) groups of the  $\sim \infty$ basic information grands the subsidiarys information 5003. recorded in separation from each othersingone synches block on the pre-set medium so that the bit allocation and the sample groups may be decoded and reproduced even if at 55 of the these sample groups are::alternately:recorded on the 20004. channel basis. It is possible with the decoding means to detect a channel having a bit quantity exceeding the pre-set reference quantity allocated thereto since the bit

the small-sized blocks divided along time and fre-

sis during decoding. Alternatively, the sample data in the coording region of the recording medium medium and a continuous continuous and a continuous con the small-sized blocks may be produced by effecting characteristic divided into a first region and a second region, and the pre-set non-blocking frequency analyses during encoded small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the basic information of plural channels is recorded in the small the s ing and by effecting pre-set blocking frequency synthesis during decoding of the frequency width for non- 910 tion is recorded in the second region all the region region regions are the second region all the region regions are the second region region region region regions are the second region region region region region region region region regions are the second region reg blocking frequency, analyses may be equated for at some between the film perorations is the first region and the least two lowermost frequency bands or set so as to be a performing tradinal region is the second region, reproduction is as to be broader with increase in frequency in at least the high-to-like possible using the remaining information during subsections est frequency band for optimum matching to the hearing and quent reproduction seven, although the sinformation as a first

ter or the quadrature mirror filter and the modified discrete cosine transform may be employed respectively and vising the information encoded by the present information and the For blocking frequency analyses, the block size may be processing method and apparatus for effective utiliza-

tics of the input signal. The block-size may be changed secretary According to the present invention, since the quanindependently for each of the output bands of at least tity of bits employed for encoding the basic information two non-blocking frequency analyses for achieving frequency analyses suited to characteristics of the input only in the compression encoding of high sound quality 253 and high picture quality but also in the encoding of the class of the According to the present invention; bit allocation; a sound or picture without; compression, encoding and the second conforming to the characteristics of the input signal is estable decoding of high sound and picture quality may be veet and achieved by changing the sum of the bit apportionment and the achieved, while there may be provided as medium; on tenth to

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a third wind a shuddy differed to limproving the encoding the first digital sinformation to sbe to National arrayed in plural regions proximate to information regions on appre-set/medium/in which the and appresecond information is arrayed; and/orable at 11.45 14. decoding the encoded first digital informations not arrayed in plural regions proximate to regions on the pre-set medium (in which the second no ECA) information is arrayed; so usfulg of this pevalue at not said first digital information having the pre-set basic information and the subsidiary information and the subsi tion for completing the basic information. And obtain the tstigjo ja iti erbiedera da ani er itri ara inta in ordarni erb

The method for processing the information as 100 000 claimed in claims wherein said first digital informa- 1020 tion includes the sound information. God to a Reference of

The method for processing the information as applied to claimed in claim 1, wherein said second information includes the sound information. APP 436 (1) 22 447 0743.4 meseriq and incommodification to a religious post-

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The method for processing the information as Assets a claimed in claim 1, wherein said first digital information is the basic information among said plural granders occasions some in the introduction of the Pr

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channels, and said second information is other subsidiary information seek in the early visited as well, a large ignine to close to also glamoran

- 5. The method for processing the information as claimed in claim 4, wherein the basic information of 5 the plural channels includes the audio information 3 00 of at least a left channel, a center channel and a right channel, and wherein the subsidiary information includes the audio information of at least a left center channel and a right center channel at the second ection in words the second information is
- 6. The method for processing the information as claimed in any one of claims 2 to 5; wherein said basic information is the information of a frequency band lower than that of said subsidiary information. 15 in necessarily become and from a major of
- 7. The method for processing the information as claimed in any one of claims 2 to 5, wherein said subsidiary information is a requantized sample of the quantization error of the basic information.
- 8. The method for processing the information as claimed in any one of claims 1:to:7, wherein said pre-set medium is a motion picture film to a last parties of กดาธิภาษ์กา bados est a abulars ก. 1125
- 9. The method for processing the information as claimed in any one of claims at to 7, wherein said pre-set mediumosis bas disc-shaped mrecording asmedium. in includes the cound information.
- 10. The amethod afor approcessing athe ainformation as a \$10.45 claimed in any one of claims it to 7 wherein said as pre-set medium/is a communication network monetone
- contemporaries of said subsidiary information. 11. The method for processing the information as 35 said first edigital, information are othose regions and defined between the perforations of a motion picture film. Profession of the extraction
- 12. The method for processing eithe information as ... claimed in claim/8, wherein said plural regions for the control of the claim/8, wherein said plural regions for the control of the claim of the clai said first digital information care those regions defined between aligned perforations on both sides of a motion picture film in phisospolin to it suits solve 45
- bise pierenni (88 ur.) 8 ermelo la chio yesi si cerri " 13. The method for processing the information as claimed in claim 8, wherein said plural regions for .... said first digital information are those regions defined between the perforations of a motion/pic- 150 ture film and an edge of said motion picture film. 2001 5
- Hower notes nutrition a timultan the c 14. The method for processing the information as claimed in claim 8, wherein said plural regions for said first digital information are those regions 55 defined between the perforations of a motion pice and ture film and an edge of said motion picture film and and between the perforations.

15. The method for processing the information as  $\omega^{(T)}(\Omega)$ claimed in claim 8, wherein said basic information in a and the subsidiary information are separately rearrayed between perforations of a row of perforations and between perforations of the other row of perforations associational phases ting to bodison and to

simed in data: 23, wherein for producing sauteful

- 16. The method for processing the information as at a claimed in claims 8, 13, 14 or 15, wherein multichannel sound signals are arrayed as said first digital information. Is suful to pulphase or should length to no excarried out diving encoding and pre-set frequency
- 17. The method for processing the information as claimed in claims 8, 13, 14, 15 or 16, wherein said as basic information and said subsidiary information are the high efficiency encoded information.

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- 18. The methodyfor/processing the information as it is claimed in claim 17, wherein said basic information 85% and the subsidiary information are time-domain or the subsidiary information are the subsidiary infor frequency-domain samples, variable bit allocation is performed on said time-domain and frequency-disdomain samples of plural channels and wherein the apportionment of total bit-allocation quantity of the bit allocation quantity for the basic information and 🖘 🤻 the bit allocation quantity of the subsidiary information, summed together to the entire channels its set so as to be substantially constant. As initial or bernis or at the of said non-branching traquency enalyses as
- 19. The method for processing the information as claimed in claim 17) wherein scaling factors for sisample data of said subsidiary information are found from the scaling factors and word lengths of a 4 000 sample data of said basic information. 2 mista of becals
- clancy analysis is modified discrete cosine transclaimed in:claim:8; wherein:said:plural:regions.for 301 320. The method for processing the information as 400 3 claimed in any one of claims 17 to 19, wherein a bit allocation equantity to rone of plural channels to be 7.2% which a bit quantity exceeding a pre-set constant reference quantity is allocated is resolved into a bit quantity: portion/of/the basic information which is yes. the bit apportionment not including channel bit allows en cation and not exceeding said reference quantity at most, and a bit quantity portion corresponding to the difference between bit apportionment including the conchannel bit allocation as bit allocation of the subsidense. iary information and bit apportionment not including them channel bit apportionment of said basic information, and wherein variable bit apportionment is a continuous done to time-domain or frequency-domain samples 10% of plural channels from channel to channel desting as reco
  - nation of the other contracts for said such 21. The method for processing the information as a claimed in claims 17 or 20, wherein said sample acres data of bit allocation of said subsidiary information is given as a difference between sample data obtained from bit apportionment including channel bit allocation and sample data: obtained from bit 16.5% apportionment not including channel bit allocation.

- 22. The method for processing the information as claimed in any one of claims 17 to 21, wherein the same quantization is carried out of sample data in a small-sized block divided along time and frequency.
- to you remo sit to another equipment this on's. 23. The method for processing the information ras claimed in claim 22, wherein for producing sample data in a small-sized block divided along time and frequency, appre-set blocking frequency analysis and comprising carrying out: frequency analyses for 10 each of plural blocks consisting of plural samples is beginning carried out during encoding and pre-set frequency synthesis comprising carrying out frequency synthesis for data processed with the blocking frequency analyses is carried out during decoding. 10 15 noceantaine Leocare, quaerales máir cates
- 24. The method for processing the information as claimed in claim 22, wherein for producing sample data in a small-sized block divided along time and frequency, a pre-set non-blocking frequency analy- 5 20 sis comprising carrying out frequency analyses without blocking is performed during encoding and wherein pre-set non-blocking frequency synthesis is performed on data processed with pre-set nonblocking frequency synthesis... of pathonic nortace list 25. a avoire disposaus seleto persuo ecitocolis lidisco
- 25. The method for processing the information has not claimed in claim 24, wherein the frequency band-so co width of said non-blocking frequency analyses is selected to be broader with increasing frequency in \$30 (1) at least the highest frequency band. There is the beginning the commentation viewers in the lowest are the
- 26. The method for processing the information as well claimed in claim 24 or 25, wherein said blocking fre-page. quency analysis is modified discrete cosine trans- 35 form. Is notified to the personal or bonded of 35. The apparatus foreprocessing the information as the ad siphered viet of the source to and sub-difference.
- 27. The method for processing the information as claimed in any one of claims 24 to 26, wherein blockoars size in said blocking frequency analysis is adap- 1:40 tively changed depending on time characteristics of agent the input signal agest excitation recommended as in an i тален ала ват.е. севанца втаа генегения циел біл ги
- 28. The method for a processing, the ainformation as as a second claimed in claim: 27, wherein: the block size is 35 changed independently for each output of at least near two of the non-blocking frequency analyses. The Williams panerial case one to tremmed case id temper.
- 29. The method for processing the information as claimed in any one of claims 18 to 28; wherein the 9050 sum of bit allocation portions for the basic information and the bit allocation portions for said subsidiary information for respective channels is changed depending on the maximum sample value or the scale factor of each channel. The manufactor of action 855 som poto i nesare i curetir cui ca pevit
- 30. The method for processing the information has into a claimed in any one of claims 18 to 29, wherein the channel-to-channel bit apportionment is changed to ac-

with time changes in amplitude information of an exenergy value, a peak value or a mean value of information signals of each channel.

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- 31. An apparatus for processing the information comprising: channels actioned the autionionic standard 4 disest a leti chamer, a comer channel and a encoding means for encoding the first digital information to be arrayed in plural regions proximate to information regions (on lan pre-set. medium in which the second information is arrayed; and/or self phiased, ig lot bondom: decoding means for decoding the encoded first digital information garrayed in optural pregions and proximate to information regions on a pre-set medium in which the second information is arrayed; and the private single the information of wherein said first digital information has the pre-set basic information and the subsidiary information supplementing said basic informa-
- 32. The apparatus for processing the information as claimed in claim 31, wherein said first digital information includes the sound information. s poperangual am popesedada ios podram self

se motion for processing are terromagness to

- 33. The apparatus for processing the information as as a claimed in claim 31; wherein said second information includes the sound information.
- 34. The apparatus for processing the information as claimed in any one of claim 32 or 33; wherein said basic information is the information of a frequency band lower than that of said subsidiary information. in a matrice for processing the incomerical as its
- claimed in any one of claim 32 or 33, wherein said 55.55 subsidiary information is a requantized sample of the basic information.
- 36. The apparatus for processing the information as claimed in any one of claims 31 to 35, wherein said pre-setimedium is a motion picture film ising of least than estra drod no englasofrug bengas drewed parm i ...
- 37. The apparatus for processing the information as claimed in any one of claims 31 to 35, wherein said pre-set medium is a disc-shaped recording medium.anolgenia. In bera trievedwick music in two still and many section of a non-control of stages of a 200 per
- 38. The apparatus for processing the information as claimed in any one of claims 31 to 35, wherein said pre-set medium is a communication network. elegan de marina en la presención de la pocomerción de la pocomerción de la presención de l
- 39. The apparatus for processing the information as (1) claimed in claim 36, wherein said plural regions for said first digital information hare those regions defined between the perforations of a motion picareas making of the Kir ture film.

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40. The apparatus for processing the information as claimed in claim 36, wherein said plural regions for said first digital information are those regions defined between aligned perforations on both sides of a motion picture film.

ensome a constitute and ensure that the court in

- 41. The apparatus for processing the information as claimed in claim 36, wherein said plural regions for said first idigital information area those regions defined between the perforations of a motion picture film and an edge of said motion picture film and an edge of said motion picture film.
- 42. The apparatus for processing the information as claimed in claim 36, wherein said plural regions for said first digital information are those regions defined between the perforations of a motion picture film and an edge of said motion picture film and between the perforations.
- 43. The apparatus for processing the information has a 20 claimed in claim 36, wherein said basic information in 50 and the subsidiary information are separately arrayed between perforations of a row of perforations and between perforations of the other row of perforations and between perforations of the other row of perforations. A confirmation was a perfection of the confirmation and 25 and perforations as a perfection as a confirmation.
- 44. The apparatus for processing the information assect claimed in claims 36, 41; 42 or 43; wherein multipose channel sound signals are arrayed as said first dig-term ital information.
- 45. The apparatus for processing the information as claimed in claims 36, 41, 42, 43 or 44, wherein said basic information and said subsidiary information are the high efficiency encoded information.
- 46. The apparatus for processing the information as claimed in claim 45, wherein said basic information and the subsidiary information are time-domain or frequency-domain samples, variable bit allocation is performed on said time-domain and frequency-domain samples of plural channels and wherein the apportionment of total bit allocation quantity of the bit allocation quantity for the basic information and the bit allocation quantity of the subsidiary information, summed together, to the entire channels, is set so as to be substantially constant.
- 47. The apparatus for processing the information as claimed in claim 45, wherein scale factors for sample data of said subsidiary information are found from the scaling factors and word lengths of sample data of said basic information.
- 48. The apparatus for processing the information as claimed in any one of claims 45 to 47, wherein a bit allocation quantity to one of plural channels to which a bit quantity exceeding a pre-set constant reference quantity is allocated is resolved into a bit

quantity portion of the basic information which is the bit apportionment not including channel bit allocation and not exceeding said reference quantity at most, and a bit quantity portion corresponding to the difference between bit apportionment including channel bit allocation as bit allocation of the subsidiary information and bit apportionment not including channel bit apportionment of said basic information, and wherein variable bit apportionment is done to time-domain or frequency-domain samples of plural channels from channel to channel.

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- 49. The apparatus for processing the information as claimed in claims 45 or 48, wherein said sample data of bit allocation of said subsidiary information is given as a difference between sample data obtained from bit apportionment including channel bit allocation and sample data obtained from bit apportionment not including channel bit allocation.
- 50. The apparatus for processing the information as claimed in any one of claims 45 to 49, wherein the same quantization is carried out of sample data in a small-sized block divided along time and frequency.

  22. 28. not since set presessing and substages.
- 51. The apparatus for processing the information as a claimed in claim 50, wherein for producing sample data in a small-sized block divided along time and frequency, a pre-set blocking frequency analysis comprising carrying out frequency analyses for each of plural blocks consisting of plural samples is carried out during encoding and pre-set frequency synthesis comprising carrying out frequency synthesis for data processed with the blocking frequency analyses is carried out during decoding and pre-set frequency synthesis for data processed with the blocking frequency analyses is carried out during decoding and land or viring a partition of the processed with the blocking frequency analyses is carried out during decoding.
- 52. The apparatus for processing the information as a claimed inclaim 50, wherein for producing sample data in a small-sized block divided along time and a frequency, a pre-set non-blocking frequency analysis comprising carrying out frequency analyses is performed during lencoding and wherein pre-set non-blocking frequency synthesis is performed on a data sprocessed with spre-set non-blocking frequency synthesis in stable and to quote at most a deciration as a deciration wherein
- 53. The apparatus for processing the information as claimed in claim 52, wherein the frequency bandwidth of said non-blocking frequency analyses is reselected to be broader with increasing frequency in the at least the highest frequency band. Placed only a least the highest frequency band. Placed only a least the highest frequency band.
- 54. The apparatus for processing the information as claimed in claim 52 or 53, wherein the frequency width of said non-blocking frequency analysis is selected to be broader with increase in frequency in at least the highest frequency band. The HIGHERT

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our signification of the loss means by the ex-

- 55. The apparatus for processing the information assurclaimed in any one of claims 52 to 54, wherein said of blocking frequency ranalysis is modified discrete and cosine transform to realized with the original transform to the modes of the said to be a said to be said to b
- 56. The apparatus for processing the information as and claimed in any one of claims 52 to 55, wherein the value block size in said blocking frequency analysis is an adaptively changed depending on time characteristics of the input signal one upon the mont signal of sectors in learness of learness and allocated in an action and claims.
- 57. The apparatus for processing the information as claimed in sclaim; 56;; wherein the block size is a 5 to 6 to 6 the non-blocking frequency analysis to be 2.15 as a clama reversed some of a review of
- 58. The apparatus for processing the information as conclaimed in any one of claims 46 to 57, wherein the sum of bit allocation portions for the basic information tion and the bit allocation portions for said subsidiary information for respective channels is changed depending on the maximum sample value or the second factor of each channels is a possible as 66 years and photo believed should be section.
- 59. The apparatus for processing the information as 25 claimed in any one of claims 46 to 58; wherein the continuous channel to channel bit apportionment its changed is with time; changes in amplitude information of ansied energy value, a peak value or a mean value of information signals of each channel or gray that going (m/30) as setumas is to be published a second insuigito (CA)
- claimed in claim 48, wherein said encoding means separates in each sync block a bit allocation sample group of the basic information allocating a bit quantity larger than a pre-set reference quantity for plural channels from the bit allocation sample group of the remaining subsidiary information of the bit allocation sample group of the basic information for plural channels for recording on said pre-set medium.
- 61. The apparatus, for processing the information assistant claimed in claim 60, wherein the bit allocation same report of the basic information and the bit allocation sample group of the subsidiary information are 2.45 alternately recorded in each channel.
- 62. The apparatus for processing the information as as claimed in claim 46, wherein said decoding means the decode and reproduce the bit-allocation sample 250 group of the basic information for plural channels and the bit allocation sample group of the subsidiary information for plural channels taken out after recording on the pre-set recording medium in separation from each other in one sync block: 1855 and 1875
- 63. The apparatus for processing the information as: 91 claimed in claim 46, wherein said decoding means decode and reproduce the bit allocation sample

information of each channel alternately recorded in each channel in one sync block and said bit allocation sample group of the subsidiary information.

leaned beween aligned perforations on both sides.

- 64. The apparatus for processing the information as claimed in claim 48, wherein said decoding means effects detection of a channel in which the bit quantity larger than the pre-set reference quantity is allocated adepending on whether the allocation bit quantity to the channel is larger than or equal to the reference quantity of the subsidiary information smaller than said pre-set reference quantity.
- 65. A medium-in-which the first digital information having the basic information and the subsidiary information completing said basic information is arrayed in plural regions, excluding those for arraying the second information, said basic information and the subsidiary information having been encoded by the method for processing the information as claimed in any one of claims dato 30 a necessary with method to processing the information as claimed in any one of claims dato 30 a necessary with method to processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information as claimed in the method for processing the information and the method for processing the information as claimed in the method for processing the information and the method for processing th
- ing the basic information and the subsidiary information completing said basic information is arrayed in plural regions excluding those for arraying the second information, said basic information and the subsidiary information having been encoded by the apparatus of for a processing the binformation has a claimed in any one of claims 31 to 64.

The properties to processing the information of a more or the profiles TS, 41, 47, 45 or 44, wherein open the information of the information afficiency encoded information.

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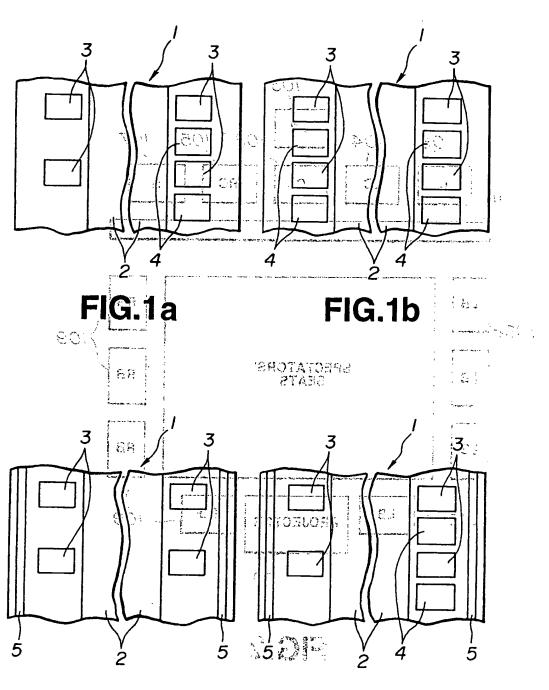


FIG.1c

FIG.1d

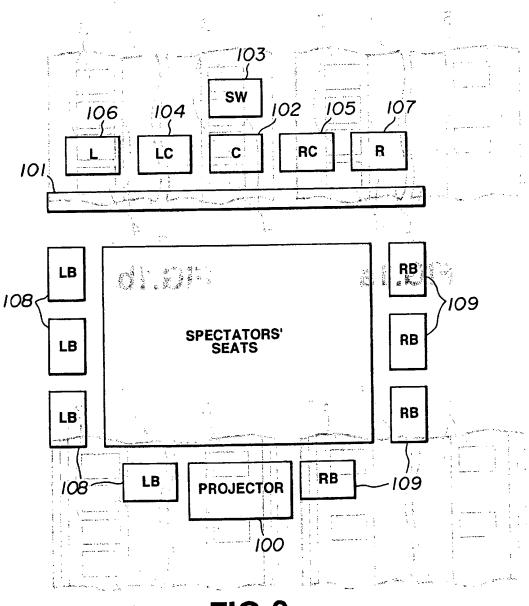
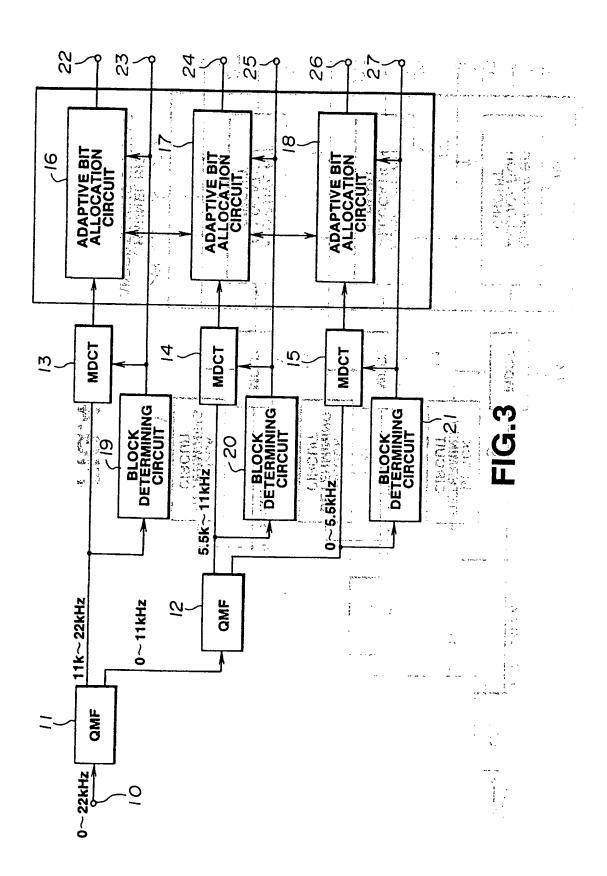
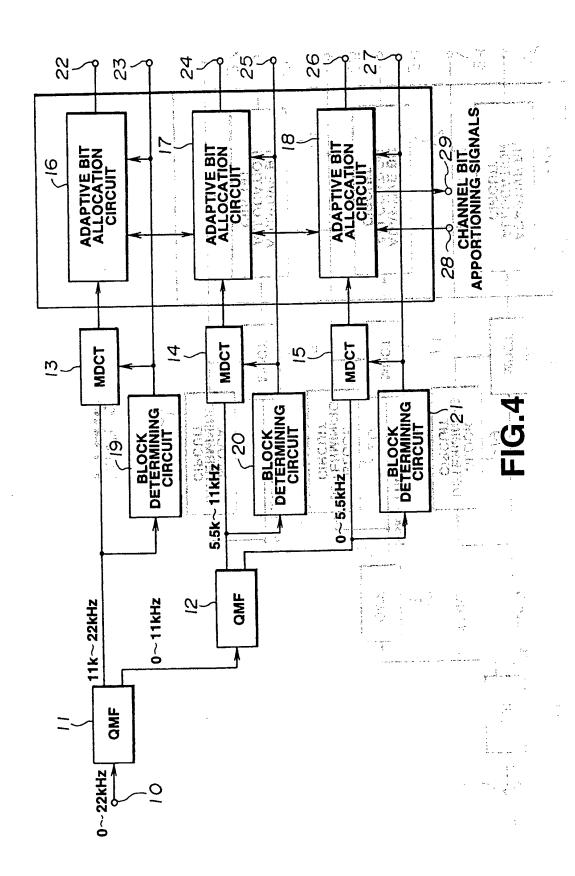


FIG.2

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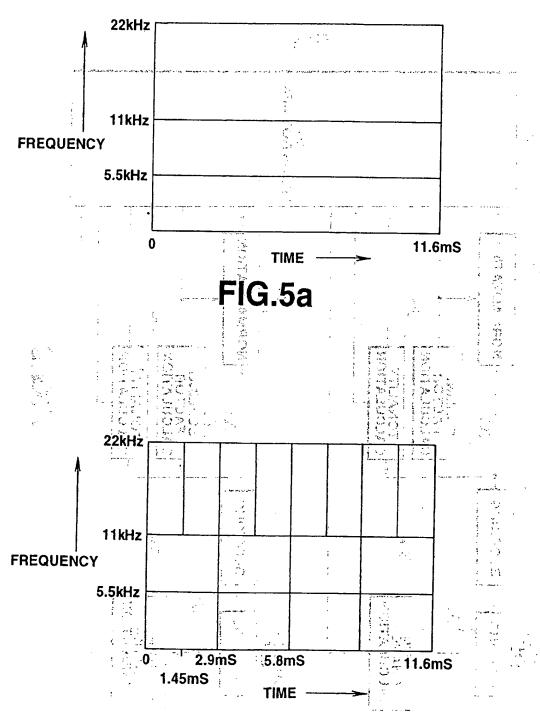
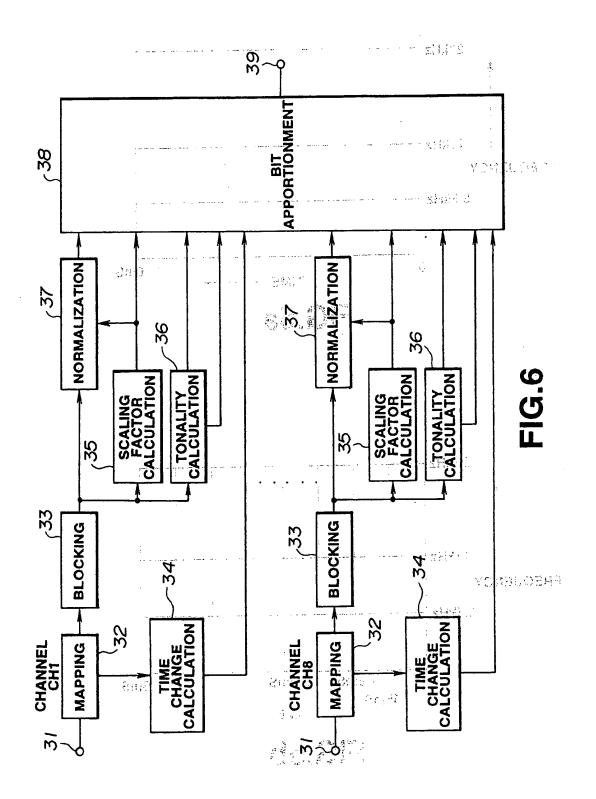


FIG.5b



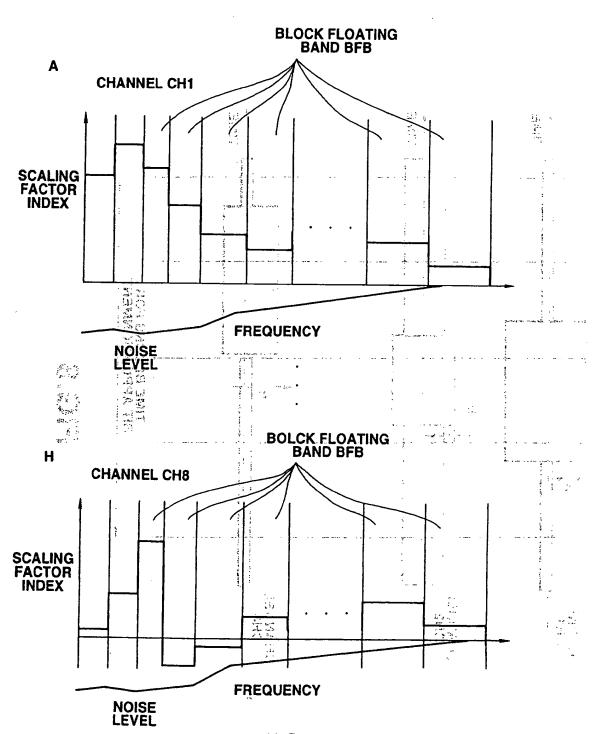
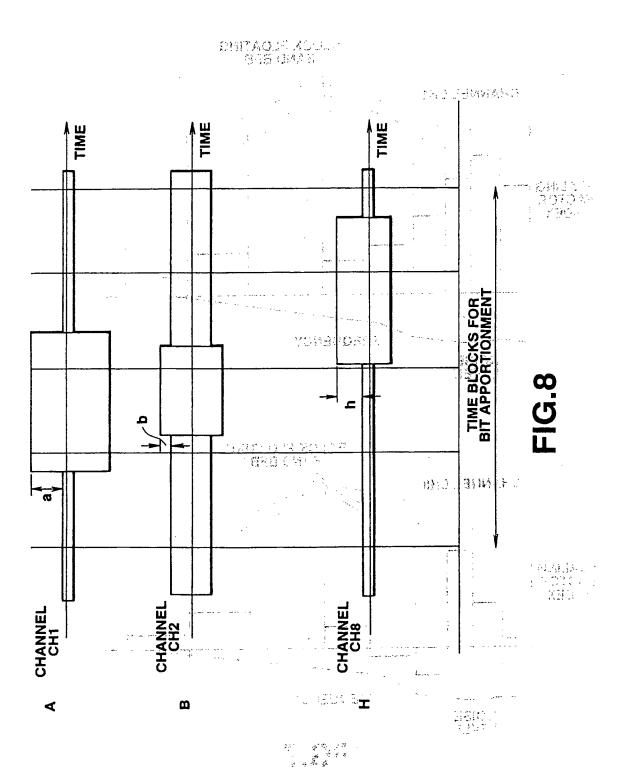
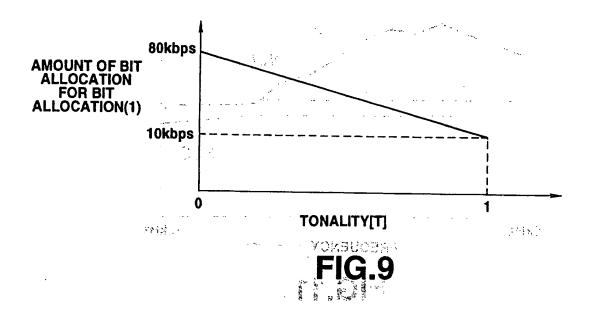
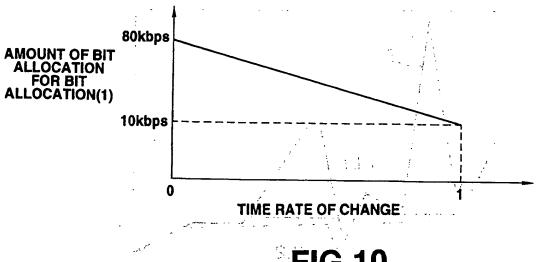


FIG.7





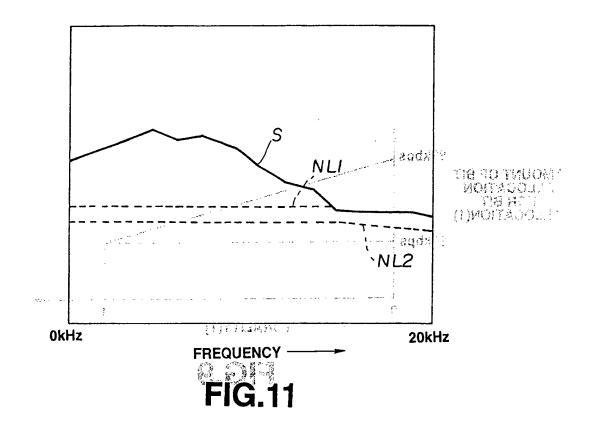


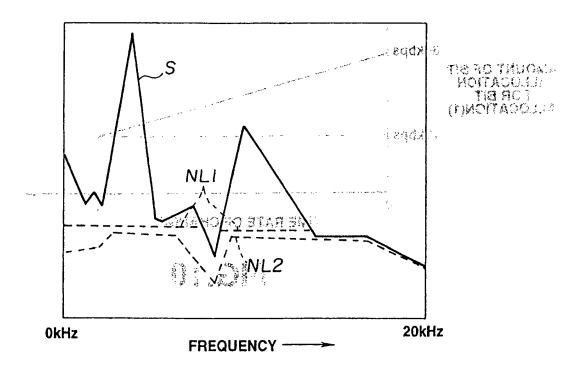
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FIG.10

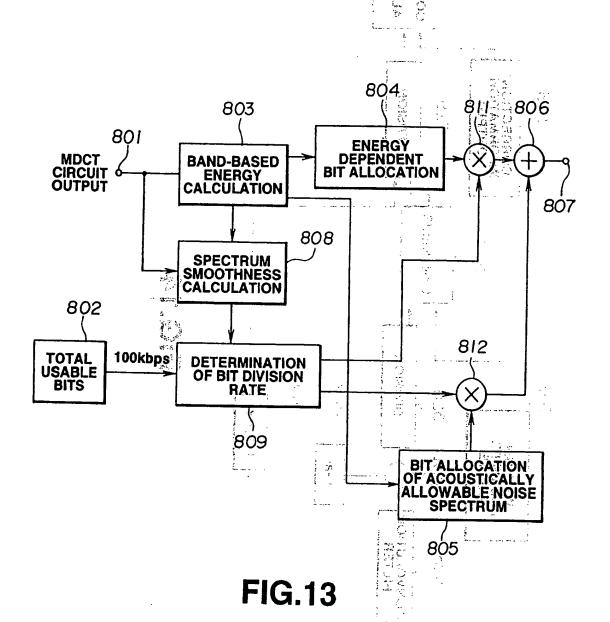
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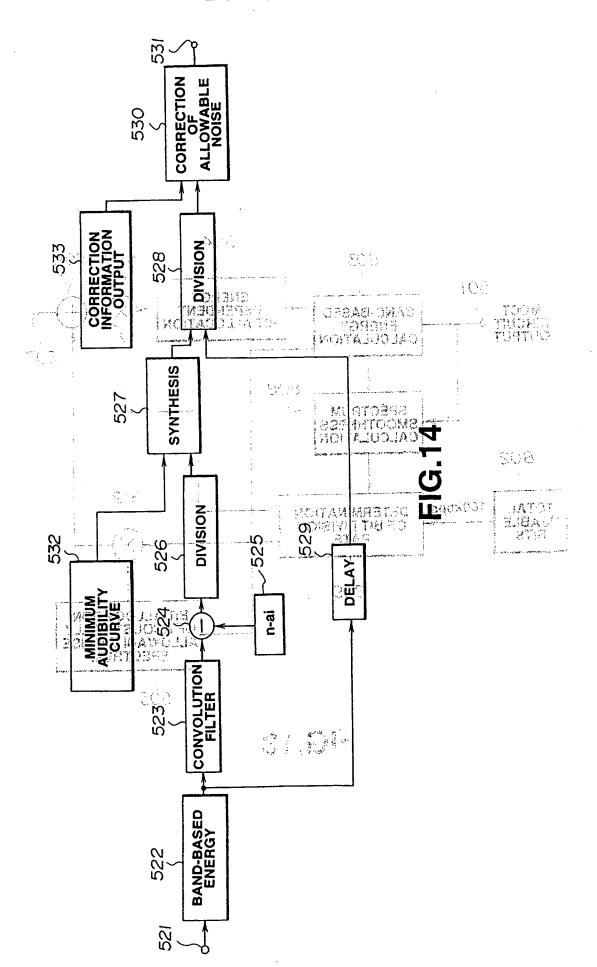
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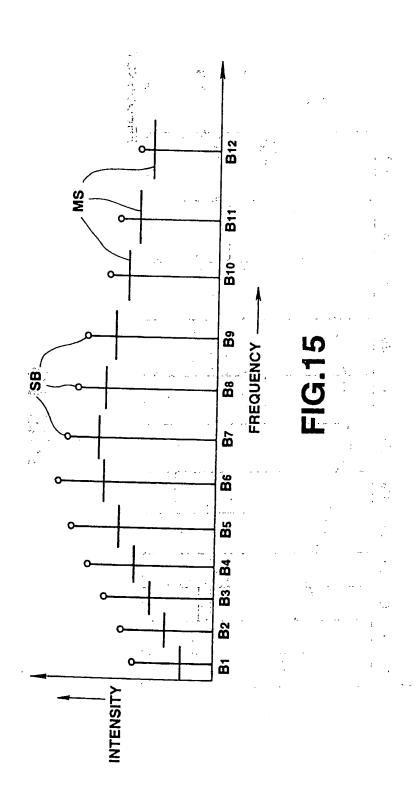


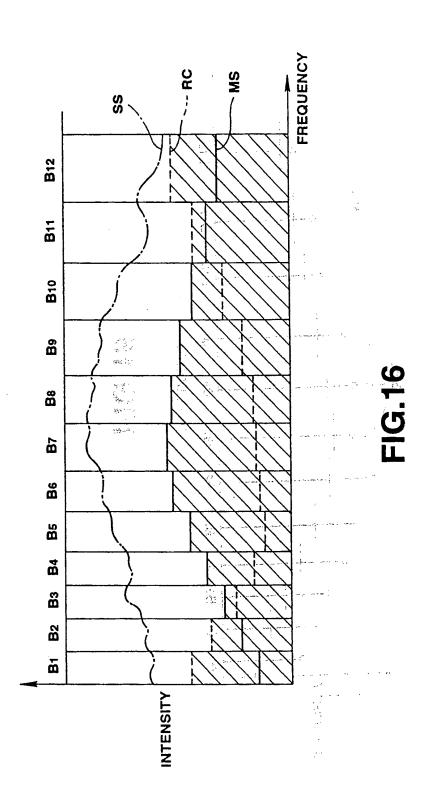


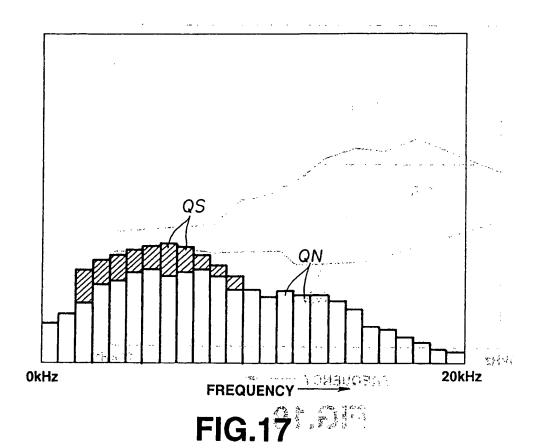
**FIG.12** 

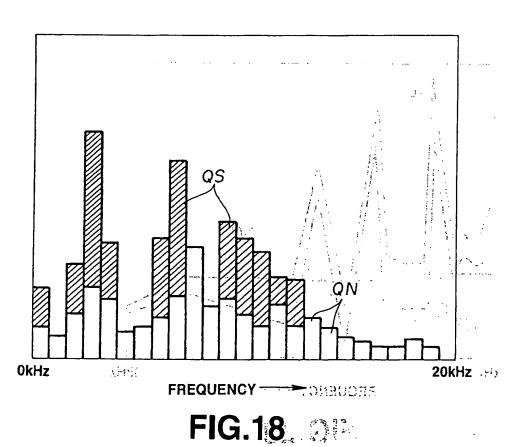












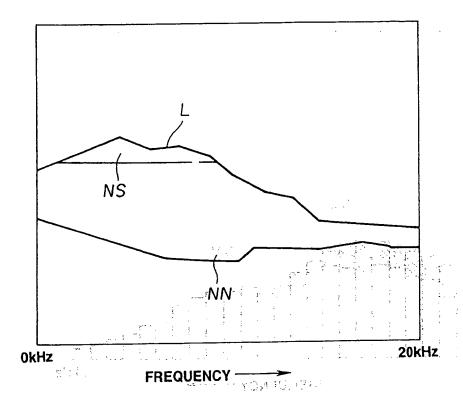


FIG.19

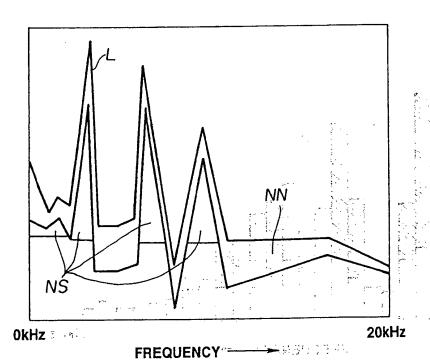
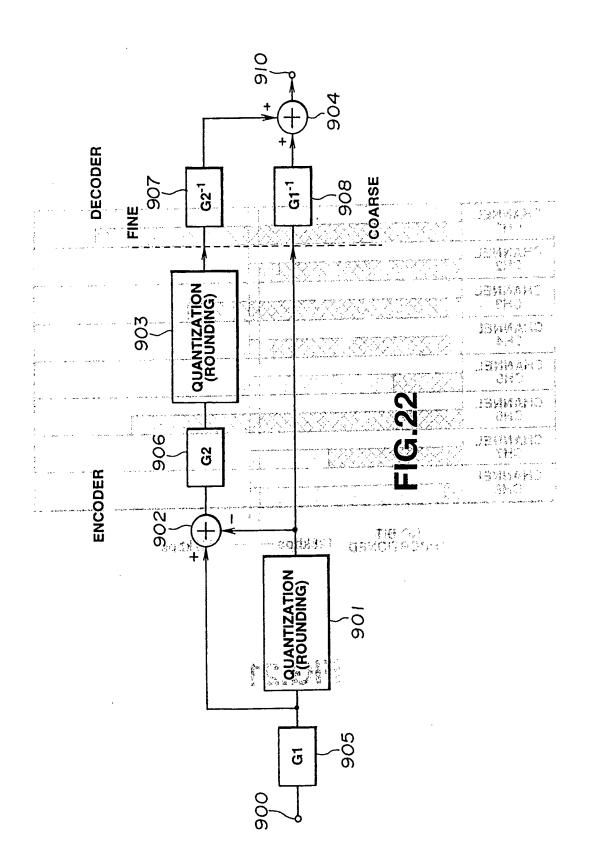
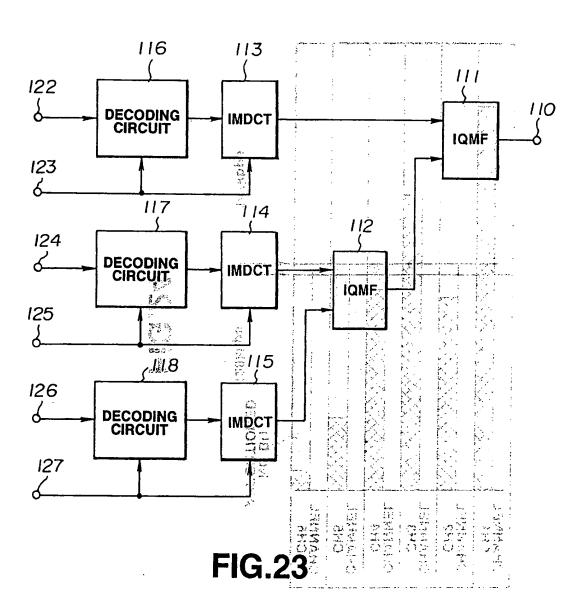


FIG.20

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CHANNEL CH1	××××××××××××××××××××××××××××××××××××××
CHANNEL CH2	***************************************
CHANNEL CH3	
CHANNEL CH4	
CHANNEL CH5	
CHANNEL CH6	
CHANNEL CH7	
CHANNEL CH8	3.8 X
	NO BIT APPORTIONED 128kbps 147kbps

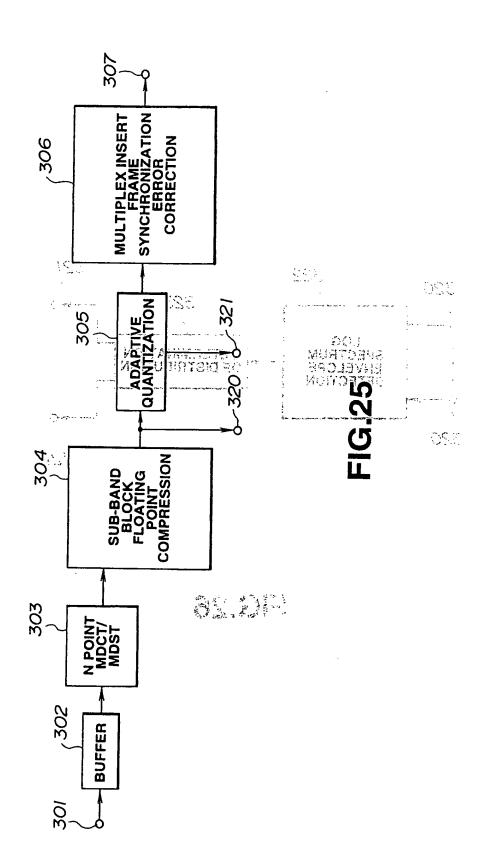
**FIG.21** 

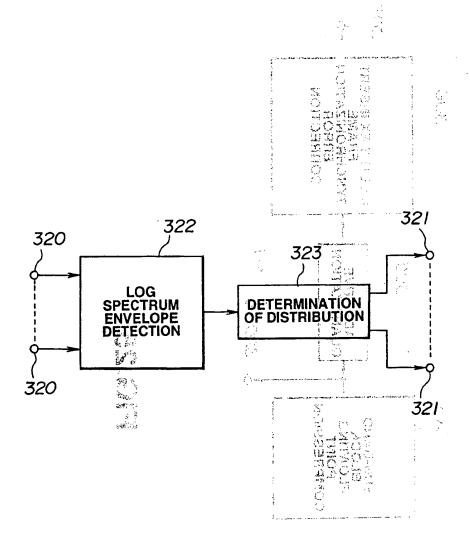




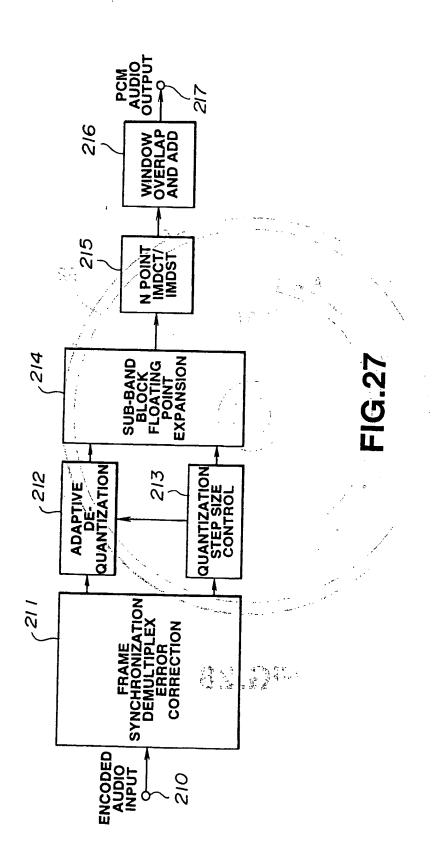
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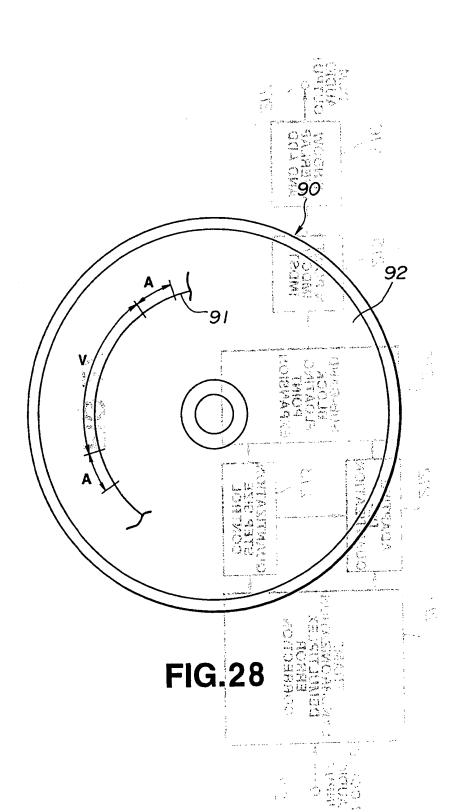
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**FIG.26** 





## INTERNATIONAL SEARCH REPORT

International application No.

JCT/JP94/02056

	ASSIFICATION OF SUBJECT MATTER		
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	to International Patent Classification (IPC) or to b	oth national classification and IPC	
	LDS SEARCHED		
Minimum	ocumentation searched (classification system follower		
Int	. С1 <sup>5</sup> G11B2O/10, H03M7/30	<b>)</b>	
Documenta Ti+	ion searched other than minimum documentation to the Suyo Shinan Koho		the fields searched
Kok	ai Jitsuyo Shinan Koho	1965 - 1994 1971 - 1994	
	ata base consulted during the international search (name		
	and the special series (need the special series (need the	ne of data dase and, where practicable, search	terms used)
c. Docu	MENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where	appropriate of the relevant more are	
			Relevant to claim No
A	JP, A, 5-250811 (Pioneer	Video Corp.),	1-66
	September 28, 1993 (28. (	09. 93)	
A	JP, A, 5-206866 (Sony Cor	rn )	17-29,
	August 13, 1993 (13. 08.	193)	45-66
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Further	focuments are listed in the continuation of Box C	See patent family annex.	
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